SYSTEMS AND METHODS FOR FOR REVERSE AUCTION OF FINANCIAL INSTRUMENTS

RELATED APPLICATION DATA

The present invention claims priority from U.S. Provisional Patent Application No. 60/211,890, titled "Systems And Methods For Reverse Auctions Of Derivatives", filed June 14, 2000, and from U.S. Provisional Patent Application No. 60/210,816, titled "Online Digital Marketplaces And Methods For Dealer-Driven Electronic Trading Of Financial Instruments", filed June 9, 2000, the entire contents of which are incorporated herein by reference. The present application also incorporates by reference the entire contents of U.S. Patent Application No. 09/169,906, titled "Systems, Methods and Computer Program Products For Electronic Trading Of Financial Instruments", filed October 12, 1998.

FIELD OF THE INVENTION

The present invention relates generally to systems and methods for electronic trading of financial instruments, and more particularly to online digital marketplaces and methods for the reverse auction of financial instruments such as derivatives.

BACKGROUND OF THE INVENTION

A wide range of instruments are traded in the over-the-counter (OTC) derivatives market including: interest rate swaps, caps, floors, FRAs (forward rate agreements), interest rate basis swaps, and interest rate options (caps, floors and swaptions) in establishing trades using voice-based systems. Today, dealers and their clients verbally explain all the terms and conditions of the derivative transactions they wish to execute to each other to ensure that both parties are talking about the same thing. This complexity

has been one of the major inhibitors in the development of an efficient and successful electronic trading. This is illustrated by the fact that today electronic trading systems are widely used in equity and foreign currency markets where the products and their attributes are relatively simple and easy to understand but the evolution towards an electronic execution and online services platform has been much slower in fixed income and the Capital Markets arena.

Clients and dealers alike can easily get frustrated trying to contact each other for the purpose of entering into a derivatives transaction. Clients often go through several iterations of discussion over the telephone with one or many dealers to get quotes and information before they are ever ready or educated enough to enter into a transaction. For example, in today's voice-based environment, an end-user of financial products such as a CFO calls one or more dealers and inquires about an instrument. This process is very time consuming because the end-user must spend time discussing their needs, receiving quotes and market information, and being qualified based on credit. The process works well if the CFO only wants to do business with one dealer irrespective of price or structure but imagine the chaos created by trying to talk to 4-5 dealers at once.

By the time the CFO is ready to enter into a transaction, he or she has been on the phone several different times with one or more dealers. The scenario is even less efficient when you consider the complexity of the products and volatility of the financial marketplace. Derivative instruments are extremely time sensitive and quotes are usually valid for a short period of time. The inability to efficiently query dealers simultaneously regarding financial products puts the CFO at a disadvantage and creates tremendous inefficiencies in the derivative marketplace.

Recent attempts to utilize technology to address and improve the ability of end-users and dealers to interact more efficiently have resulted in systems that lack functionality demanded by market participants such as credit filtering, anonymous trading, and maintaining cherished client-dealer relationships. Two models that have been developed so far have represented opposite ends of the spectrum. The first approach only allows an end-user to transact with a single dealer. No access to other dealers they may have a credit or banking relationship with is permitted through the system. As a result, a user of this system is unable to solicit requests for prices from

other dealers, which prevents competitive pricing. Users must have access to multiple systems, one with each dealer in order to service all of their existing dealer relationships. The second approach takes the opposite view and allows an end-user to broadcast an inquiry to all dealers logged into the system. The name of the end-user is revealed upon delivery of the inquiry and the dealer's name and price are also revealed when they respond with a quote. This allows for a competitive bidding process except no dealer will want to use it because they don't have the option of remaining anonymous when they submit a price.

Dealers that have spent time and money establishing and qualifying relationships with clients are naturally sensitive to any system that may cause them to lose clients, especially to dealers that did not prescreen based on credit quality. Neither the single dealer system nor the multiple dealer systems work because these concepts don't reflect the competitive or complex nature of the derivatives marketplace.

What is needed, or rather, demanded by the marketplace is the capability for dealers to setup credit preferences based upon their own models and provide both counterparties, end-users and dealers, with the option of choosing to remain anonymous or disclose their identities during the bidding process and restrict activity with counterparties where there is an existing banking relationship. End-users will be able to obtain prices from multiple dealers without the problems inherent in using a voice-based system by utilizing the present invention's unique electronic reverse auctioning process to anonymously obtain bids simultaneously from one or many participating dealers, as discussed in greater detail below.

Major financial institutions have internal processes in place to ensure that counterparties meet suitability and credit requirements before any trades are permitted. While every institution performs these tasks in some form, all have their own methodologies in place for determining how creditworthy their direct counterparts are, taking into account external factors as well as the size of their assets or loan portfolios. Bilateral master or collateral agreements are setup well in advance based on the nature of the relationship. The dealer, based on the financial strength and sophistication of the client, defines the relationship with the client and determines which products are suitable

to trade. This measure of current and future financial strength and stability is then used to determine with whom, for how much, and for how long they will accept a transaction.

A dealer's portfolio of executed trades is constantly monitored and updated depending upon how many transactions are outstanding and the general financial health of each party. These measures may be updated daily, depending upon the severity of changes in the markets and the individual financial institution's situation. Dealers establish their own criteria for determining the credit worthiness of a counterparty, which is an expensive and time consuming process. As such, they are very hesitant to share the names or credit qualities of clients with whom they have existing banking relationships.

SUMMARY OF THE INVENTION

The present invention comprises systems, methods, and computer program products that provide for electronic trading based on the client/server model, including a central processing center (*i.e.*, server) having multiple server modules and a plurality of individual trader workstations (*i.e.*, clients), all of which are operationally interconnected, preferably via an Internet-protocol network. Because of the open architecture of the system, it is possible that the system may run within the context of an Internet browser on a user's existing desktop computer. At the user's workstation, the user may select from a variety of different interfaces that enable the user to follow markets, enter and execute trades, and monitor outstanding and historical orders and executions. Thus, the user is provided an in-depth view of the market and essentially complete control over the order load process.

The market information provided to the user is coded with credit preference data generated by referencing the complex credit preferences inputted by each user regarding all possible counterparties. Thus, potential counterparties are then able to identify which orders they are eligible to trade based upon the coded credit preference data.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a computer network implementing an electronic trading system in accordance with an embodiment of the present invention.

FIG. 2 is a block diagram illustrating the architecture and functionality of a central processing center in accordance with an embodiment of the present invention.

FIG. 3 is a block diagram illustrating the architecture and functionality of a trader system in accordance with an embodiment of the present invention.

FIG. 4 is a block diagram illustrating the architecture and functionality of a business unit proxy in accordance with an embodiment of the present invention.

FIG. 5 is an example of a command center interface.

FIGs. 6A-6B are examples of different tabbed partitions of a user preference interface.

FIG. 7 is an example of a credit preference setting interface.

FIGs. 8A and 8B are examples of different tabbed partitions of a modify credit groups interface.

FIGs. 9A and 9B are examples of the new binary interface and complex preference interface respectively, which are accessible from the credit preference setting interface.

FIG. 10 is an example of a business unit information interface.

FIG. 11 is an illustration of the credit preference logic of an embodiment of the present invention.

FIG. 12 is an example of a market entry interface.

FIG. 13 is an example of a symbol definition interface.

FIG. 14A is an example of an passive order interface.

FIG. 14B is an example of an hit order interface.

FIG. 15 is an example of a market detail interface.

FIG. 16 is an example of an outstanding order blotter interface.

FIG. 17 is an example of a client monitor interface.

FIG. 18 is an example of a execution notification and quantity negotiation interface.

FIG. 19 is an example of a term negotiation interface.

FIG. 20 is an example of a user position portfolio interface.

FIG. 21 is an example of a switch interface.

FIGs. 22A and 22B are examples of an auction interface and a switch auction interface, respectively.

FIG 23 is an example of a main screen interface in accordance with an embodiment of the present invention.

FIG. 24 is a flowchart of the credit preference feature in accordance with an embodiment of the present invention.

FIG. 25 is a flowchart of the subject based addressing feature in accordance with an embodiment of the present invention.

FIG. 26 is a flowchart of the execution of a trade in accordance with the embodiment of the present invention.

FIGs. 27A and 27B are flowcharts of a trade execution from the perspective of the user posting the order and the user acting on the order, respectively, and in accordance with an embodiment of the present invention.

FIG. 28 is a flowchart of the position discovery feature in accordance with an embodiment of the present invention.

FIG. 29 is a flowchart of the auction feature in accordance with an embodiment of the present invention.

FIG. 30 is a detailed flowchart of the auction feature in accordance with an embodiment of the present invention.

FIG. 31 is a flowchart of the calculation of the average auction price in accordance with an embodiment of the present invention.

FIG. 32 is a flowchart of the matching performed in an auction in accordance with an embodiment of the present invention.

FIG. 33 is a flowchart of the validation of a resulting order in an auction in accordance with an embodiment of the present invention.

FIG. 34 is a process flow diagram illustrating operations and functionality of the central processing center in accordance with an embodiment of the present invention.

FIG. 35 is an example of a login interface.

FIG. 36 is an example of a dealer selection interface.

FIG. 37 is an example of a request for price interest interface.

FIG. 38 is an example of a credit approval interface.

FIG. 39 is an example of a request for price interface.

FIG. 40 is an example of request for price market interface.

FIG. 41 is an example of a request for price acknowledgement interface.

FIG. 42 is another example of a request for price acknowledgement interface.

FIG. 43 is a flowchart of the reverse auction process in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

I. Introduction

The following description is of a best-contemplated mode of carrying out the present invention. The systems, methods, and computer program products of the present invention have practical application in anonymously trading a very broad cross-section of credit-sensitive, bilateral financial instruments. However, a particular application of the present invention described hereinafter is directed to the use of the present invention for trading financial instruments in the derivatives market. The scope of the present invention should not be limited to that described hereinafter, but should be determined by referencing the appended claims.

The present invention provides for a standardized contract definition, and means for matching complex credit preferences of each counterparty before a trade is executed. Therefore, potential counterparty users are able to identify bids and offers that they are eligible to trade based on credit preference information provided before initiating a trade. The present invention also permits users to place passive orders (bids or offers on the various financial products for other counterparties to actively choose from to hit (bids) or

lift (offers), without the posting user doing anything further) or active orders (where the viewing user actively initiates the trade by selecting passive bids or offers which are already in the system). This gives a user maximum control over the order flow process. For instance, there may be a situation whereby the bids in a particular market are higher than the offers, but no trading is taking place. This situation may occur when the credit quality of the best offer (which in this case would be below the bid) would not be good enough for a bidder to be willing to enter into a transaction with that counterparty. This is a significant difference from the prior art systems in which orders are automatically matched if the prices are equal because such prior art systems typically limited the user's control over the order flow.

The present invention also provides financial markets with electronic trading systems and methods for identifying possible counterparties and executing trades for forward rate agreement (FRA) switches and other financial products. The present invention further provides the ability for the users to place orders for various financial instruments via an auction process that can be one-to-many or many-to-many, whereby the system automatically matches all orders and determines the prices and quantities executed on the basis of several guidelines or parameters. A further feature of the present invention is an auction trading that is available to users, whereby users can use an auction process to trade FRA switches with the other counterparties. This form of auction is referred to hereinafter as a switch auction. In the auctions, the price is preferably pre-determined by the system prior to the auction taking place. The prices determined by the system are referred to hereafter as the fair price.

The systems and methods of the present invention are designed to reflect the fact that financial institutions operate under many different structures. In order to accomplish this, the following concepts/definitions are provided:

Legal Entity (LE):

This is the incorporated entity in which contracts are negotiated on behalf of by users (traders) of the system.

Business Unit (BU):

This is a grouping of individual users within a Legal Entity that act together and share attributes such as LE, manager, address,

settlement information, credit preferences (see below), etc.

Risk Equivalent (RQ):

This is the unique measure of Risk associated with financial contracts such that contracts with different attributes can be compared on a like basis for credit risk purposes.

Credit Preferences (CP):

This is the model which allows the system to handle different measures of risk equivalent used by different institutions and different financial contracts, all with different internal structures.

Classes of Financial Instruments (CL):

These are collections of financial contracts which share similar attributes.

Credit Groups (CG):

A method to allocate credit preferences across classes of financial contracts.

User Preferences (UP):

A method to allow institutions or users to control or manage access to the functions within the system.

Filters (FI):

These allow users to limit the messages (*i.e.*, request for price or request for switch they receive or view.

Symbology (SY):

This enables users to quickly and easily reference financial contracts within the system in a systematic manner.

Term Negotiation (TN):

This is a method which allows users to negotiate non-commercial terms of contract subsequently to a trade. For example, the exchange of bonds relating to a spread trade.

Credit Over-Ride Process:

This process enables a user to disclose his/her identity to a counterparty to see if they will accept a trade with him/her even though they initially refused him due to credit issues.

Comprehensive Confirmations:

This is a confirmation lay-out in order to fully define bilateral contracts across any classes of financial instruments.

Request For (RF)

This is a method to broadcast to the other users (subject to their FI) an interest in a price or market.

II. System Architecture

As will be appreciated by one of ordinary skill in the art, the present invention may be embodied as a method, a data processing system, or a computer program product. Accordingly, the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment combining software and hardware aspects. Furthermore, the present invention may take the form of a computer program product on a computer-readable storage medium having computer-readable program code means embodied in the storage medium. Any suitable computer readable storage medium may be utilized including hard disks, CD-ROMs, optical storage devices, or magnetic storage devices.

The present invention is described below with reference to block diagrams and flowchart illustrations of methods, apparatus (*i.e.*, systems) and computer program products according to an embodiment of the invention. It will be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, respectively, can be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus create means for implementing the functions specified in the flowchart block or blocks.

These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable

memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, blocks of the block diagrams and flowchart illustrations support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flowchart illustrations, and combinations of blocks in the block diagrams and flowchart illustrations, can be implemented by special purpose hardware-based computer systems which perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

A trading system in accordance with the present invention is an electronic brokerage system which may use Internet protocol-based communications networks for facilitating the trading (*i.e.*, buying and selling) of financial derivatives by users, each of which is associated with the user's own desktop computer system (trader system) located on the trading floor of a financial institution (client site), as described below. At the user's desktop computer system, the present invention is preferably implemented by a Java-based software program, though other suitable program languages can be utilized such as dynamic hypertext markup language (DHTML), C+ or C++.

As shown in FIG. 1, a trading system **10** in accordance with the present invention comprises a central processing center **12** which is in communication with the client sites **14** via one or more of a variety of Internet protocol based networks **16**. By way of illustration, a private extranet, a public Internet, and a third party extranet are show, though it will be recognized by those skilled in the art that other networks such as the Public Switch Telephone Network (PSTN) may be implemented as a network **16**. Further, by having multiple networks **16** available, the user is provided redundancy in case one network experiences a service interruption, and the user is able to choose

between the several networks **16** for primary access based on factors such as toll charges or bandwidth.

Each client site **14** includes one or more business unit servers **18** which, among other things, can store copies of the Java applets which can be utilized to implement the present invention. The business unit servers **18** may also perform encryption/decryption functions for messages that are received and sent over the networks **16**. The business unit servers **18** are preferably connected to the client sites **14** internal data network. Thus, one or more trader workstations **20** may be connected to a business unit server **18** of a client site **14**. Accordingly, a user's own desktop computer which is connected to the client's internal data network may function as a trader workstation **20** and run the Java-based software of the present invention to enable interaction with other trader workstations **20** via the central processing center **12**.

With reference to FIG. 2 , illustrated is the central processing center **12** which includes a trade mechanism **30**, a group server mechanism **32**, auction mechanism **34**, and a switch mechanism **35**, all in accordance with the present invention. The trade mechanism **30** includes several modules including a market inventory module **38**, an execution module **40**, and a settlement module **42**. The market inventory module **38** holds the passive orders for each market and broadcast the same to the trader workstations **20** when new orders are received, validates any proposed trade, performs a second and final credit preference check that cannot be performed at the trader workstation **20**, validates that both traders are still on-line (*i.e.*, active), executes the trade, and sends out a status update to the traders. The execution module **40** receives the executed trade and proposes a trade for a greater quantity if applicable (referred to as the will-do-more feature), and processes term negotiation if applicable. The settlement module **42** calculates the appropriate commission, generates the confirmation, and sends the confirmation to the two parties.

The group server mechanism **32** interfaces the trader module **30** with the trader workstations **20**. The central processing center **12 m**ay include a plurality of group server mechanisms **32**, each of which preferably serves a subset of the users (*i.e.*, trader workstation) of system **10**, though the system **10** may be implemented with only one group server mechanism **32**. The group server mechanism **32** monitors the connection of

each trader workstation **20** so that log-in and log-out times and usage can be monitored. The group server mechanism **32** also caches market information being viewed at each trader workstation **20** and create an order identification code that uniquely identifies that order. The credit preference information of all users is cached in by the group server mechanism **32** for delivery to each trader workstations **20** when the associated user logs in. Any changes in the credit preference setting by a trader are detected and forwarded to the trader workstations **20** of the other users.

The switch mechanism **35** is configured to receive a portfolio of interest reset risk for a plurality of users and provide the users with an anonymous view at their relative position to other possible counterparties and available trades that may offset the user's interest rate reset risk. The auction mechanism **34** performs a switch auction function whereby orders or FRA's are received from the users and anonymously matched based on an algorithm that takes user credit preferences into consideration.

The trader mechanism **30**, group server mechanism **32**, auction/switch auction mechanism **34**, and switch mechanism **35** may be collectively implemented as market module **44.**

The central processing center **12** includes a processor **50** that communicates with the other elements within the central processing center **12** via a system interface **52.** An input devise **54**, for example a keyboard or a pointing device, is used to input data from a user, and a screen display device **56**, for example, a monitor, is used to output data to the user. A memory **58** within a central processing center **12** includes the market module **44** and a conventional operating system **60** which communicates with the market module **44** and enables execution of the market module **44** (including the trade mechanism **30**, group server mechanism **32**, and auction mechanism **34**) by processor **50**. An external communication line **62** is provided to interface the central processing center **12** with other computer systems or computer-based devices such as networks **16**. Lastly, a hard disk **64** may be provided as a persistence memory device, as well known to the industry. Preferably, a relational database **66** resides on the hard disk **64** for maintaining information such as current state information for each trader workstations **20**, user and business unit data, financial instrument definitions, order states, transaction states, confirmation states, historical confirmation and transaction data, credit

preferences of all business units, and historical market data. Preferably a relational database **66** resides on the hard disk **64** for maintaining information such as current state information for each trade workstation **20**, user and business unit data, financial instrument definitions, order states, transaction states, confirmation states, historical confirmation and transaction data, credit preferences of all business units, and historical market data. Preferably, the relational database **66** is based on structured query language (SQL) management system, as well known in the industry.

With reference now to FIG. 3, illustrated is an embodiment of the trader workstations **20** which includes a trader module **70** in accordance with the present invention. The trader module **70** may be implemented as a component of a Java-capable Internet browser program **72**, such as Netscape Communicator® (Netscape Communication Company) or Microsoft® Internet Explorer (Microsoft Corporation) version 3.0 or higher. Thus, in a preferred embodiment, the trader module **70** is a Java-based program that is downloaded as Java applets for each session and implemented by a Java virtual machine (JVM) **73** within the Internet browser **72**. The JVM **73** of the Internet browser program **72** may be a stand alone software application, a plug-in application, or a helper application, all of which is well known in the art. The trader module **70** includes a market interface module **74**, a credit preference module **76**, a symbol module **78**, switch module **80**, and an auction module **81**. The market interface module **74** comprises one or more user interfaces for presenting information to the user. In the context of the present embodiment, a user interface is provided as a window within the context of the Internet browser program **72**. However, a user interface in accordance with the present invention may take many forms such as a three dimensional virtual reality world based on virtual reality modeling language (VRML), an audio receiver/transmitter, or any other suitable form of interface between the user and trader workstations **20**. In a preferred embodiment, the market interface module **74** comprises a control center interface, market entry interface, market detail interface, switch interface, and auction interface, all of which are described in more detail hereinafter.

The credit preference module **76** receives the stored credit preferences inputted by the user and stored at group server mechanism **32**. The stored credit preferences include preferences directed to the other business unit's legal entities, and the preferences

inputted by the other users directed toward the business unit's legal entity of the subject user. As mentioned above, the credit preference information is preferably stored in the database **66** (FIG. 2). The credit preference module **76** may encode the order information being presented to the user with the credit preferences of the user and the credit preferences of counterparty that posted the order. The credit preference module **76** also performs a credit preference check for each order when a trade is initiated. Because of the potential complexity associated with the different types of credit methods offered by the present invention, portions of the credit check process may be performed by the market inventory module **38** of the central processing center **12**. The credit preference module 76 at each trader workstation **20** comprises a simplified matrix of yes's and no's, and associated maturities. If the business unit has selected an even more complex method (*i.e.*, complex), a unit (such as a risk quotient, *i.e.*, RQ) by maturity is also required. The trader workstation **20** will therefore not be able to determine whether the full quantity can be traded. Thus, the market inventory module **38** repeats the credit check to ensure the very latest credit preferences are used (in case of any latency in updating the credit preferences at the trader workstations **20**) and to complete any complex credit preference check for quantity.

The symbol module **78** stores the symbol definitions utilized for the subject-based addressing of the different financial instruments traded in the system **10**. The symbol module **78** also provides means for defining new symbols for use with the system **10**. The switch module **80** is configured to receive interest rate reset risk portfolios from the user which are sent to the switch mechanism **35** at the central processing center **12**. The relative position information generated by the switch mechanism **35** is returned to the switch module **80** which presents the position information to the user via the market interface module **74**. The auction module **81** is configured to receive multiple or batch orders on a single instrument at different price levels, and in case of a switch auction, to receive a interest rate reset risk portfolio from the user. The inputted orders or portfolio is sent to the auction server **34** at the central processing center **12** where the auction or switch auction, respectively, is performed. The resulting matches are returned to the auction module **81** which presents the results to the user via the market interface module **74**.

The trader workstations **20** includes a processor **82** that communicates with other elements within the trader via a system interface **84**. An input device **86**, for example, a keyboard or pointing device, is used to input data from the user, and a screen display device **88**, for example, a monitor is used to output data to the user. A memory **90** within the trader workstations **20** includes the Internet browser program **72** (and thus, the trader module **70**) and a conventional operating system **94** which communicates with the Internet browser program **72** and enables execution of the Internet browser program **72** (and thus, the trader module **70**) by processor **82**. It is noted, however, that the trader module is preferably implemented as a Java-based program that is downloaded into memory **90** for the execution during a single session, and the trader workstations **20** will not persistently store the trader module **70**. Further, as a Java-based program, the trader module **70** will be executed on a JVM **73** which is a component of the Internet browser program **72**.

An external communication link **96** is provided to interface the trader workstations **20** with other computer systems or computer-based devices such as respective business unit servers **18**. Lastly, a hard disk **98** may be provided as a persistent memory device, as well known in the industry. It is noted that the trader workstation **20** may comprise a desktop computer system as previously mentioned, or alternatively, the trader workstation **20** may comprise a portable computing device such as a notebook computer, handheld PC, personal digital assistant (PDA) or any other suitable device capable of running an Internet browser program and creating a communication link for interfacing with a network.

Therefore, a user of the system **10** is not necessarily tied to a specific hardwired terminal, but has a virtual terminal that goes with the user wherever the user has access to a Java capable browser and Internet access. The trader module **70** may be implemented as an independent program capable of establishing a communication link to the central processing center **12** via the Internet, a local area network (LAN), or a wide area network (WAN). Thus, the user can even have access to the system **10** via direct modem dial-in to the central processing center **12** over the public switched telephone network (PSTN) or Internet.

With reference now to FIG. 4, illustrated is an embodiment of a business unit server **18** which includes a proxy agent **110** in accordance with the present invention. The proxy agent **110** may perform numerous functions including decoding and encoding encrypted messages sent and received over networks **16**. The proxy agent **110** manages traffic to and from the trader workstations **20**, and may provide other features such as document caching and network access control. The proxy agent **110** may improve performance by storing and supplying frequently requested data to the trader workstations **20**, or by filtering and/or discarding information from the networks **16**. Preferably, proxy agent **110** resides on a business unit server **18** which is part of the respective client sites **14** internal data networks. However, the system **10** of the present invention may be implemented without business unit servers **18**, whereby the functionality of the proxy agent **110** may be incorporated into the trader module **70** of the respective trader workstation **20**; such functionality including decoding and encoding encrypted messages, and network management.

The business unit server **18** includes a processor **112** that communicates with the other elements within the business unit server **18** via a system interface **114**. An input device **116**, for example, a keyboard or pointing device, is used to input data from a user, and a screen display device **118**, for example, a monitor, is used to output data to the user. A memory **120** within the business unit server **18** includes the proxy agent **110** and a conventional operating systems **122** which communicates with the proxy agent **110** and enables execution of the proxy agent **110** by processor **112**. An external communication link **124** is provided to interface the business unit server **18** with other computer systems or computer/based machines such as networks **16** and trader workstations **20**. Lastly, a hard disk **126** may be provided as a persistence memory device, as is well known in the industry. Particularly, the hard disk **126** may include trader data profiles **128** for each of the different trader workstations **20** associated with the business unit server **18.** Alternatively, the trader data may be stored at the central processing center **12** so that the trader does not need to re-build his/her screens each time he/she longs onto the system **10**.

Thus, each trader workstations **20** at a client site **14** is able to access the system **10** through the Internet browser program **72** operating on the user's desktop computer. In

order to access the system **10**, the user may run Java-based applets on the desktop computer in the Internet browser program **72** which may be up-loaded to the desktop computer system by one of three means: 1) accessing them from the hard disk of the desktop computer 2) downloading them across the network from a server on the internal data network of the client site, or 3) by downloading them directly from the central processing center. Once the applets are loaded and running in the desktop computer of the user, the user is then able to access the system **10** and interact with other trader workstations **20** and engage in trading activities. In addition to traders at the client sites, a preferred embodiment of the present invention also enables non-trader users at the client sites **14**, such as credit officers and other interested/relevant staff, to have access to the invention in the same manner as the users in order to monitor the trading activities, perform credit control or any other functions.

III. System Features

The following are features of the present invention which provide particular functionalities and utilities. These features include interfaces such as a command center interface, a market entry interface, a market details interface, an outstanding order interface, an historical order interface, and functions such as symbology, credit preference checking, term negotiation, automatic notification, interest rate reset risk switches, and order auction.

When beginning a session on the system **10**, a user at a trader workstation **20** launches the Internet browser program **72** and goes to a particular address that connects the trader workstation **20** to the central processing center **12**. This is preferably achieved by typing a known URL (Universal Resource Locator) in an address field of the Internet browser program **72**. At the URL entered, the user will be presented with a log-on screen which preferably requires the user to input a user name and password for identification, verification and security reasons. After the user logs on, the user will download (preferably from proxy agent **110**) the Java applets which will run locally on the desktop computer comprising the trader workstation **20**. Alternatively, the user may launch a local or network application that runs locally or on an attached server. The application will enable a connection to system **10** over network **16**, much the same as numerous

dial-up services such as AOL. In addition, other information such as user defined preferences which are based on the trader's profile will be downloaded to the trader workstation **20**. This may include information on what the user is allowed to trade, what markets the user is interested in monitoring, and other user specific information that was previously been defined by the user or another individual such a credit officer or the like.

After the user has successfully logged on and the requisite Java applets have been downloaded and are running on the JVM **73**, the user is presented with a command center interface **130**, as illustrated in FIG. 5, via the screen display device **88** (FIG. 3). The command center interface **130** is the front end of the user interface which provides access to all other features of the present invention, as described below. In an embodiment of the command center interface **130**, the command center interface **130** is a pop-up window rendered on the screen display device **88**. Note, however, when the command center interface is running, the user may be able to iconize (*i.e.*, minimize) the Internet browser program **72** window, as may be desirable when the user no longer needs to view the Internet browser program **72**.

From the command center interface **130**, a user can access the features of the system **10** which enable the user to monitor and control their trading in the system **10**. Specifically, from the command center interface **130** the user can access the following areas of functionality as menu options on the tool bar **132**: a market entry interface (described below with reference to FIG. 12), a credit settings interface (described below with reference to FIG. 10), a switch engine interface (described below with reference to FIG. 22), auction interface (See FIG. 13), tools, a user preference interface (described below with reference to FIGs. 6A and 6B), an historical order blotter interface (described below with reference to FIG. 17), an outstanding order blotter interface (described below with reference to FIG. 16), links to external applications such as MarketSheet™ (a trademark of TIBCO, Inc.) (referred to herein as the quote screen and graph screen for illustrative purposes), a logout interface (provides secure exit from the system **10**), and a help interface where detailed on-line help is provided. The menu options that appear in the tool bar **132** are preferably customizable to a user, and those described are merely illustrative.

In addition, the command center interface **130** provides a message display window **134** for displaying real-time messages. These messages include system information, market information, requests-for-prices (RFPs), requests-for-switch (RFS) or online chat sessions with the users of the system **10**. Below the message display window **134**, the command center interface **130** displays the user's name **136**, the user's default currency **138**, the user's business unit **140**, and other relevant information. The background color of the message display window preferably changes if the connection to the central processing center **12** is lost for any reason.

A user preferences interface **148**, which is accessible from the command center interface **130** via the tool bar **132**, provides a user with user preference features, such as those illustrated in FIGs. 6A and 6B. In FIG. 6A, a Derv Filters tab enables a user to set request-for-price (RFP) filters for viewing different derivative instruments based on the type (*i.e.*, class) of derivative instruments and the currency. The user may also select the manner of presentation (*i.e.*, highlighted or not). From the Derv Filters tab, the user is able to add and remove the derivative instruments from the user's viewing list, that is, the list of instrument that will appear on the message display window **134** of the command center interface **130**. In FIG. 6B, an Environment tab enables a user to select viewing options to change the appearance of the display. In regard to the color coding display option, it is noted that the user can select not to have order information color coded by selecting color blind user. In such a case, other means of notation are utilized such as markings or symbols, as may be desirable if the user is color blind or using a monochrome screen display device **88**. User defaults for Credit Group, Instrument Class and SWF Currency may also be selected via the environment tab.

At this point, it is worth noting several functionalities that are integral to the operation of the present invention. In particular, it was recognized that in order to achieve an electronic trading system for a wide range of financial contracts, a solution had to be developed to solve two very critical problems: (1) how to identify financial contracts, and (2) how to allow institutions to describe their credit preferences or relationships for these instruments. As solutions to these problems, the present invention provides the symbology and credit preference features described below.

The symbology of the present invention was developed because, unlike foreign currency trading, where the financial instruments are simple, verbally explaining all the terms and conditions of a derivative transactions can be a laboriously complex process which can take a relatively long period of time to explain. Furthermore, most derivative transactions are specifically customized to fit a particular need. With derivatives, as compared to stocks, bonds or other financial instruments, there are typically many more parameters, such as the maturity, fixed interest rate, floating interest rate, currency, floating rate index, and calculation rates, which are important and are preferably defined. This complexity has allegedly been one of major inhibitors to the development and implementation of an efficient inter-dealer electronic trading system for over-the-counter (OTC) derivatives.

The symbology will, among other things, ensure that the symbols are intuitive to the trading community, allow new symbols to be system generated when new instruments are introduced, and enable detailed confirmations to be prepared. These goals are generally accomplished by systematically dividing the parameters, terms, and conditions defining these derivatives instruments into a four-part subject code. This four-part subject code enables the users to reference these instruments via a form known as subject-based addressing. The four-part subject code is divided as follows: SOURCE.CLASS.SYMBOL.CURRENCY. Each field of the four-part subject code is defined below.

The source field of the symbology identifies the source of the information. In most cases, this will be the code DNI (*i.e.,* Derivatives Net, Inc.), the assignee of the present invention. If the symbol is used within the system **10**, then the source field of the symbology will be assumed to be DNI, and will be omitted. If the symbol is used in a larger context, then the source will be identified. If, for example trade data were to be distributed and accessed via a third-party data distribution system such as the type operated by Reuters, Inc., then the source field of the subject code would be used.

The class field identifies the principal product class into which the financial instrument falls. The class parameter is designed to group financial contracts together which share similar attributes. For purposes of the present disclosure, eleven classes of instruments, each with distinct characteristics covering forward rate agreements, interest

rate swaps, interest rate basis swaps, interest rate options, foreign exchange and switches, will be covered. It is noted that a switch is the simultaneous purchase and sale of two instruments within the same class. The following is a listing of the eleven classes and the associated abbreviation for each:

FRA - forward rate agreement
SWP - interest rate swap
CAP - interest rate option (cap or floor)
SOP - interest rate option (swaption)
IBS - interest rate basis swap (floating vs. floating swap)
SPT - foreign exchange spot
FWD - foreign exchange outright forward
FXS - foreign exchange swap
SWF - FRA switch
SWT - switch any other pair of instruments in the same class
CBS - currency basis swap

The symbol field is the principal code used to define each instrument. The symbol field is the most explicit field of the subject code. This component of the naming convention enables the underlying structure of the derivative instrument to be defined. A simple description (*e.g.*, 1yrswap) could be used, but this does not allow new derivative instruments to be easily added. The legend below defines the parameters for defining each of the different instruments or classes. The symbol relies on the definitions of the underlying parameters, which will allow further break down or definition. For example, FLOPT is a two letter code which describes the variable rate index to be used, and will include: the designated maturity, index name, source, non-business day convention and calculation description. The symbols of the present embodiment are as follows:

FRA: [START, END, OVER, FLOPT]
SWP: [START, END, OVER, FXDBASIS, FLOPT, SPECIAL RULE]
CAP: [START, END, OVER, FLOPT, TYPE, STRIKE]

SOP: [START, OVER, UNDERLYING SWAP, SOPTYPE, STRIKE, OPTTYPE]

IBS: [START, END, OVER, INDEX1, INDEX2, ARREAR]

SPT: [CCY1(terms), CCY2 (base)]

FWD: [CCY1(terms), CCY2 (base), START, END, OVER]

FXS: [CCY1(terms), CCY2 (base), START, END, OVER]

SWF: [FLOPT, DAY1, DAY2]

SWT: [ASSET1, ASSET 2, CLASS]

CBS: [START, END, OVER, INDEX1/CCY1, INDEX2/CCY2]

The symbol fields set forth above include the following parameters:

START: The START parameter is the month the contract commences offset from value date, *i.e.*, 1,2,3,..,13,...,360. The default setting for the START is (0) which represents that a contract starting with the current month. Also, see OVER below.

END: The END parameter is the final maturity from value date in months adjusted for the OVER, and represents the term, *i.e.*, 1,2,3,..,13,...,360. If the value date is 28th of November, then a contract defined as [1,4 over the 12th] translates into a deal starting on the 12th of January and maturing on 12th of April.

OVER: The OVER parameter represents a specific date in the appropriate month. For example, if today is the 3rd December (value date is the 5th of December), then a 1*4 over the 12th would start the 12th of January, the first date over one month but less than two months beyond the spot date. This allows a contract to be defined with any start date between days 1-31. Note that this represents the actual date and not the number of days forward. The default setting for the OVER is (0), which represents spot starting. Two other parameters are allowable: (I) which represents IMM (International Monetary Exchange) rolls (the system **10** covers the different IMM conventions defined by the currency market, that is, the

third Wednesday or second Thursday) and (E) which represents rolls over the month-end.

FXD BASIS: The FXD BASIS parameter is a two-part code covering the frequency and the basis of the fixed coupons. Examples are FREQ: M=Monthly, Q=Quarterly, S=Semi-annually, A=Annually, Z = Zero Coupon plus BASIS F=A/365 Fixed, B= 30/360, M=A/360, I=A/365 ISDA, *etc.* For instance, SM is semi-annual A/360 or semi-money].

FLOPT: The FLOPT parameter is a two-part code covering the frequency and the index type of the floating coupons, and represents the floating rate option as defined by ISDA. The FLOPT parameter covers frequency, basis and source. Although each currency may have a default, most indices will be available. FLOPT examples are L=Libor (TELERATE 3740/50), P=Pibor (TELERATE 20071), T=Tibor, C=CDOR, B= AUS Bills (REUTERS BBSW), FF= Fed Funds (HI5), TB= T-bills (H15), PR= Prime (H15), CP= 30 day Commercial Paper, BE= BELO, S= STIBOR, TA= TAM, A=AIBOR, D=CIBOR (REUTERS DKNK), RL = Libor from Reuters LIBO, and IL= Libor from Reuters ISDA.

CAPTYPE: The CAPTYPE parameter includes definitions for cap (C) and the floor (F). Thus, in a preferred embodiment, the following code is utilized: C= Cap, F= Floor.

SOPTYPE: The SOPTYPE parameter includes definitions for payers (P) and receivers (R). Thus, in a preferred embodiment, the following code is utilized: P= Payers, R= Receivers, X=Call, Y=Put.

OPTYPE: The OPTYPE parameter is the option type: (E)uropean, (A)merican or (M)ultiple European.

STRIKE: The STRIKE parameter indicates the cap or swaption's exercise rate or price set on the option. Any strike defined in the symbol as ATM (at-the-money) will be shown as such in this parameter. In such a case, the percentage or strike will be agreed through the term negotiated process discussed below.

SPECIAL RULE: The SPECIAL RULE parameter is designed for currencies such as USD and CAD which are in particular markets that use few special conventions for trading. For example, semi-bond for spread trades and annual money for out-right swaps are widely used in these markets. The SPECIAL RULE parameter allows the system **10** to set more than one set of defaults for any currency. This will allow the system **10** to know when the exchange of bonds is required following a transaction. The follow are the rules for the present embodiment:

A – Default in all currencies

S – USD spread trades. The default in USD is annual money versus 3 month LIBOR. This rule defines semi-bond spread trades where bonds are exchanged in the terms negotiation function described below.

2 – CAD spread trades. The default in CAD is annual money (A/365 fixed) versus 3 month CDOR paid semi-annually. This rule defines semi-annual A/365 fixed versus 3 month CDOR paid semi-annually where bonds are exchanged in the terms negotiation function described below.

3 – AUD long trades. The default for AUD is a quarterly/quarterly structure. This applies for trades up to and including three years. In trades over three years, the convention switches to a semi/semi structure. This rule supports a semi/semi structure.

4 – AUD spread trades. Its is conventional to trade swaps in the AUD market against the bond futures contracts with an agreement for an exchange for physical.

5 – GBP spread trades. The default in GBP is annual money (A/365 fixed) versus 6 month LIBOR. This rule defines semi-annual A/365 fixed

versus 6 month LIBOR where bonds are exchanged in the terms negotiation function described below.

ARREAR: The ARREAR parameter defines when the coupon(s) on a swap is both set and paid. Most interest rate swaps set their floating rate coupons at the beginning of the period and pay them at the end of a coupon period. In an ARREAR swap, however, the coupon is set and paid at the end of the period. This is commonly referred to as an arrears swap. The system **10** allows for this in the form of a basis swap.

DAY1/2: The DAY1/2 parameter is the number of calendar days offset from today to the start of each FRA in an FRA switch (class SWF). Thus, the DAY1/2 parameter represents the setting day or date.

CCY1/2: The CCY1/2 parameter is the currency code and is defined by the ISO codes for foreign exchange instruments.

UNDERLYING SWAP: The UNDERLYING SWAP parameter is the full symbol, alais or security ID of the interest rate swap that underlies an option.

INDEX1/2: Basis Swaps are when both sides are a floating rate, and the index represents the FLOPT plus the currency code of each index. The first listed index (INDEX1) is paid by the buyer. Examples include 1L-USD, 3L-GBP, PR-USD, etc. The second index (INDEX2) is received by the buyer. These are substantially identical to the codes used in the switch mechanism **35** (FIG. 2). For currency basis swaps, it is assumed that an exchange of principals takes place at the start and end on the contract.

ASSET1/2: The class SWT is provided to allow for the trading of switches in other classes other than FRAs. ASSET1 and ASSET2 represent the symbol, alias

or security I.D. of each underlying contract. Note that both should be provided from the same class of contracts.

SETTLE: The SETTLE parameter is a flag indicating whether a swaption is cash or physical settlement. The default is cash (C).

An example of an order in accordance with the symbology of the present invention is DNI.FRA.1,4.0,3L.USD, where DNI is the source, FRA is the class, .1,4.0,3L is the symbol and USD is the currency. In particular, the symbol field defines a 1 by 4 (*i.e.*, 3 month starting in 1 month) FRA on a 3 month LIBOR spot starting. Note that a comma (,) is used in the symbol fields as a delimiter. Another example of an order in accordance with the symbology of the present invention is DNI.SWP.0,60,0,AB,6LA.DEM, where DNI is the source, SWP is the class, 0,60,0,AB,6LA is the symbol and DEM is the currency. In particular, the symbol field defines a five year (60 month) annual bond (AB) versus a 6 month LIBOR swap.

Accordingly, the Symbology described above is designed to capture the parameters or commercial terms of a derivatives instrument which affect the instrument's valuation. The present invention provides a number of default values which are assumed at all times. For example, the following is an exemplary list of system default values.

ROUNDING: The rates observed on the source page or document will be used unless otherwise agreed. Rates should be rounded to 5 decimal places after any operation of averaging.

RESET DATES: This will be defined with reference to payment dates. The reset dates should be offset by the standard number of days for the currency, for example, two business days for USD.

BUSINESS CENTERS TO APPLY TO RESET DAYS: The business days used to define the current offset for reset dates is defined by the source and not the payments under the transaction. For example, London will always be used for

LIBOR (the exception is for USD LIBOR which uses both London and New York City) and New York City for H.15 rates.

INTERPOLATION: Where interpolation is required, a straight-line method using the reference rates on either side of the desired date should be used.

CALCULATION PERIODS: First and not last convention. Therefore, the calculation period includes the first payment date but excludes the next payment date.

TERMINATION DATE: All termination dates will be subject to adjustment if they fall on a non-business day.

ADJUST CALCULATION PERIOD: The number of days is assumed to adjust if the payment days are adjusted for non-business days.
TRADE DAY: The trade day is defined relative to the instrument and currency by the system **10**, and not by the location of either of the parties to the transaction.

NET PAYMENTS: Net payments will be assumed for all transactions completed through the system **10**.

CANADIAN DOLLAR SWAPS: The convention is to set quarterly and pay semi-annually using weighted averaging and compounding at the first rate.

DATES: All dates are listed unadjusted for non-business days.

Users may also want to be able to negotiate other parameters which do not affect the valuation of the derivative instrument, but are still very important. These parameters are referred to hereinafter as non-commercial terms. The difference between commercial and non-commercial terms can be vary ambiguous, and therefore, some of the terms designated as commercial below may be designated as non-commercial and become

default settings so as to be part of the symbology parameter. For purposes of illustrating the present invention, non-commercial terms have been given default values which the users can change by negotiating new values for these terms between themselves via the system **10**. However, both counterparties (users) must agree on the new value to over-ride the system defaults. Table 1 below provides a list of parameters that maybe negotiated, that is, the non-commercial terms:

PARAMETER	DESCRIPTION	SETTING
Legal	The format of the legal agreement used	ISDA, BBA, FX
Month-end	Whether coupon payment dates roll on month-end dates or not	YES, NO
Settle	For swaptions whether the contract is cash or physically settled	CASH, PHYSICAL
First Setting	For swaps the first variable rate is normally known for spot starting instruments. The current setting can quickly become off market on days where the market moves substantially. The system will display the default at all time.	SETTING displayed on market entry interface.
ATM	For options, symbols will be set up where the strike is defined as at-the-money (note: pre-defined strikes will also be available). The actual strike will be negotiated immediately following the transaction by the two parties.	The system forward rate will be available
Spot	For foreign exchange swaps (class FXS only) where the price is transacted in the form of points, the spot level to be	The system mid spot price will be available

	used will be negotiated immediately following a transaction.	
Base	Switches will be transacted in the form of the relative price between the two instruments being switched. The base rate maybe negotiated immediately following a transaction.	The system mid price will be available
Bond Exchange	For USD, CAD and GBP interest rate swaps transacted as a spread, the price and number of bonds will be negotiated immediately following the transaction	The system will list the benchmark bonds to be used and will calculate a default price and number according to market convention.

TABLE 1

Because the above symbols that comprise the subject-based addressing may be complex, users may occasionally desire a simpler naming convention to reference the more commonly traded derivative instruments. To facilitate more rapid referencing of an instrument by a user, the symbology of the present invention provides aliases. An alias is merely an abbreviated version of the subject-based address for the more commonly used terms for an instrument. The database **66** (FIG. 2) maintains a unique security identifier (such as a numeric code, *e.g.,* 111222) for each symbol which can be used in the system **10**. Thus, the symbology of the present invention enable traders and other users of the system **10** to quickly reference a particular derivative instrument in the system **10** in three ways: the full symbol, the alias, and the identifier.

The currency field of the symbology contains the code that defines the currency of the instrument represented. In a preferred embodiment, the currency code is represented by the standard ISO currency codes, *i.e.*, USD, DEM, JPY, GBP, FRF, NLG,

BEF, AUD, CAD, ITL, ESP, DKK, SEK, EUR, *etc*. The default currency will be set by each user in each user's preferences interface **143** (see FIG. 6B). This will allow the currency code field of the symbology to be omitted much of the time. However, foreign exchange trades (FXS) preferably include the currency code. Further, the currency code represents the currency which will be indexed in equal amounts for both the spot and forward coupons.

The credit preference feature of the present invention provides for the bilateral credit status between two entities to be captured, structured and used anonymously for the trading of a wide range of financial contracts. In prior art systems, credit information was primarily used to deal with settlement risk in trading spot foreign currency. In such prior art systems, the credit line or limit is usually expressed in amounts of currency which equates with the quantity or volume of a particular trade. As trades are executed between counterparties, the amount of the limit is decreased in a corresponding amount to the trade executed until there is little or no remaining credit, and then further trading is prevented until the trades settle or the credit limit amount is re-set. In foreign currency trading, the settlement process is completed in only a few days, after which both counterparties have exchanged the currencies, and then there is no further credit risk between them (*i.e.*, the trades have settled). This is vastly different from derivatives trading, where the amount at risk is normally not equal to the principal or quantity of the transaction and the obligations under the contract may continue into the future. Derivative trades can be anything from spot (the normal settlement of a foreign exchange contract) to thirty years into the future. Therefore, the resulting credit exposure (*i.e.*, the value of a contract at a future time) is over the life of a contract of an unknown amount.

The credit preference feature of the present invention is configured to handle the significant long-term credit problems inherent in over-the-counter (OTC) derivatives transactions. These long-term credit problems are further compounded by the fact that there is no standard method for banks to internally monitor and manage their credit risks. Most banks have developed their own, often proprietary, methods of monitoring and measuring the credit risk embedded in large portfolios of derivatives. Furthermore, banks also have different methods for dealing with the many different financial instruments that exist in every market.

The credit preference feature of the present invention addresses these problems and provides a viable solution. The credit preference feature of the present invention achieves this, at least in part, by introducing a measurement unit of credit risk referred to as risk equivalent (RQ) which allows for different instruments to be compared on a like basis using a standardized measuring methodology, which together with the concepts of contract maturity, credit groups, classes, credit preferences, legal entities and business units allow the system **10** to offer a solution to the credit risks embedded in bilateral, term derivatives contracts. The present invention also provides for the designation of credit groups. A credit group is a grouping of classes of financial contracts that a business unit wishes to be treated in a like manner for credit purposes. In a preferred embodiment, three default credit groups will be available: (1) Derivatives – SWP, IBS, CAP, SOP, FRA, CBS; (2) Switches – SWT, SWF; and (3) foreign exchange. Any other combination may be set up by the business unit, as desired.

Credit preferences are the methods or rules selected by a business unit within a credit group for the system **10** to use to screen prices (bids or offers) and trades against all other legal entities. In a preferred embodiment, the following three credit preferences are provided, though it will be appreciated by those of ordinary skill in the art that other credit preferences may be utilized in accordance with the present invention:

Method 1: Binary (simple yes/no) - This is used where mark-to-market (MTM) agreements exist between the counterparties. MTM are bilateral, collateral agreements which are common and reduce the credit risk between two parties to almost zero by the posting of collateral against the value of a portfolio of derivatives covered by a single ISDA (International Swap and Derivatives Association) master agreement.

Method 2: Line Binary - takes into account the maturity (quoted in months from trade date) of the financial contract.

Method 3: Complex – This is based on the RQ of each contract within maturity bands. The system calculates a RQ for each instrument in the

form of a constant currency unit expressed as a percentage. Each business unit has the choice of using the system generated RQ unit or to provide their own.

In the binary method, a business unit makes a yes or no determination as to whether or not they will deal with a particular counterparty for a particular credit group. In this credit preference, the decision is binary; there is no maximum maturity limit (*i.e.*, time limit) or quantity limit (*i.e.*, amount) in the binary method. The binary method is the broadest of the three credit preference definitions provided for herein. Typically, the binary method will be used to refuse credit, where MTM agreements exist or where the credit exposure is small (for example, in switches).

In the line binary method, it is assumed that the business unit will deal with a particular counterparty for a particular credit group. However, the line binary method adds a further restriction of a maximum maturity of any contract tradable. The added restriction is preferably expressed by the number of months into the future. The binary method is particularly well suited for used by institutions that are not yet using RQ units, but which desire a method to limit potential exposure to longer dated contracts (for example, a temporary step).

The complex method allows each business unit to exactly stipulate the amount of new risk that they are prepared to enter into with any other legal entity for each credit group by maturity band. The complex method enables a business unit to specify not only a particular maturity, but also a particular quantity or amount based on a measure of RQ. Further, the complex method enables the business unit to specify this for more than one period in time. For example, a business unit can specify that for Bank A, they will do up to $100 million out for 5 years, and then only $50 million from thereafter out to 10 years, and nothing thereafter.

Risk is generally defined herein as the degree of uncertainty of future net returns. Credit risk is further defined as an estimate of the potential loss due to the inability of a counterparty to meet its obligations. Thus, while the risk in a particular transaction depends not only on the changes in market rates and credit standing of the counterparty to the transaction, the credit risk or exposure is the nominal amount that can be lost when a

counterparty defaults on its obligation. As previously mentioned, the credit risk in a derivatives transaction is relatively complex. For instance, though derivative contracts come in many forms, the majority have a fair credit value of zero at the time the transaction is initially entered into. That is, no funds are transferred between the parties at the time the contract is created. Rather, the contract places an obligation on both over the term of the contract. Further, both parties are entering into a contract which requires them to accept a certain amount of risk. The RQ is a unit of credit risk which allows all contracts to be compared on a like basis, at virtually any point in time. The RQ is the credit exposure in terms of a percentage of the principal.

The calculation of RQ is based on the potential exposure averaged over a series of time points, weighed by an appropriate discount factor. There are several methods of calculating the exposure of a transaction, though the RQ is calculated herein using an option pricing approach, as described below.

For a certain party, a transaction can be viewed as two opposite cash flows. Inflows are assets, denoted by A(t), and outflows are liabilities, denoted by L(t). Therefore, the current exposure may be expressed as follows:

$$E(t)=\max(A(t)-L(t),0)$$

This formula is similar to the intrinsic value of a call option. The key difference is that both A(t) and L(t) can be random. Thus, following the same structure by the Black-Scholes, then:

$$EE(t) = A\,\phi(d_1) - L(t)\,\phi(d_2),$$

where

$$d_2 = d_1 - \sigma(t)\sqrt{\tau(t)}$$

$$d_1 = \frac{\log\left(A(t)/L(t)\right) + \frac{\sigma^2(t)}{2}\tau(t)}{\sigma(t)\sqrt{\tau(t)}}$$

where $\sigma(t)$ is the daily volatility (in percent) that takes into account that both A(t) and L(t) are random. The maximum exposure estimate is based on the following equation:

$$ME(t) = A(t) - L(t) + A(t)\left[e^{1.65\sigma(t)\sqrt{\tau(t)} - \frac{\sigma^2(t)}{2}\tau(t)} - 1\right]$$

Thus, the RQ can be expressed as:

where

$$RQ = \frac{AEE(t)}{\text{Principal}} * 100\%$$

where

$$AEE(t) = \sum_{t=0}^{N} \omega(t) \mathrm{E}[\mathrm{E}(\mathrm{t})]$$

where $\delta(t)$ is the discount factor at future time t.

$$\omega(t) = \frac{\delta(t)}{\sum_{0}^{N} \delta(t)}$$

For FRA's, the following equations apply:

A(t)=*$discountFactor$(t,s)*x+(1+$floatingCoupon$)*$discountfactor(t,e)$

where

floatCoupon=1*(e-s)/floatBasis*floatRate, and

L(t)=1*$discountFactor(t,s)$*x+$(1+fixCoupon)$*$discountfactor(t,e)$

where

fixCoupon=1*(e-s)/fixBasis*fixRate,

for t<s, x=1, and

for t>=s, x=0.

Then we can apply the above formula for RQ to get the expected exposure at time t. By choosing the time partition t0,t1,t2…., tn and calculate the expected exposure at each point and use the formulae of RQ, the RQ of this FRA can be calculated.

For SWAP's, the following equations apply for any time (t_i<t<=t_{i+1}):

$$A(t) = \sum_{j=l}^{n} floatingCoupon(t_j) * discountFactor(t,t_j) + 1 * discountFactor(t,t_n), \text{ and}$$

$$L(t) = \sum_{j=l}^{n} fixedCoupon(t_j) * discountFactor(t,t_j) + 1 * discountFactor(t,t_n),$$

where *floatingCoupon*(t_j) is the floating coupon at time t_j, and *fixedCoupon*(t_j) is the fixed coupon at time t_j. Then apply the formulae of option pricing approach, we can get the expected exposure at time t, by averaging the expected exposure with the discount factor, the RQ can be calculated.

At this point it may be worthwhile to distinguish the credit preference feature of the present invention from other known systems. The credit preference of the present invention does much more than merely monitor the amount transacted between two counterparties and then reduce the amount available accordingly. The prescreening performed by the credit preference of the present invention is used to prescreen possible trades based on each counterparty's credit preferences. The present invention does not control a user trading and does not directly limit the user's future trading based upon the user's past trading. In fact, it is quite possible that a new transaction may reduce the exposure between two legal entities. A user's business unit is responsible for monitoring the credit exposure of the business unit with respect to all legal entity counterparties, and for adjusting the credit preferences in the system **10** accordingly. This is a significant difference from prior art systems that automatically decrease the amount available to trade with respective counterparty as transactions are executed. The credit preference of the present invention represents an improvement over such systems because the balance of risk is based on the total portfolio between the two parties and not merely the new transactions, and the balance of risk will be affected by market movements, deals executed outside the system **10**, and internal changes to the ratings.

Credit decisions for OTC derivatives are considered different from many other financial instruments. In general, a credit decision for an OTC derivative is a function of, among other things, the composition of the user's current derivatives portfolio, the current level or prices of the financial markets, new financial transactions, and the rating or level of credit worthiness of each legal entity. Therefore, more sophisticated means such as the credit preference prescreening of the present invention is needed to adequately measure and manage credit exposure in the OTC derivatives market, as well as with other financial markets.

The present invention enables the user to set desired credit preferences for each legal entity via the credit preference interface **170**, as illustrated in FIG. 7. A user can

navigate to the credit preference interface **170** by selecting the credit settings button in the tool bar **132** of the command center interface **130** (FIG. 5). The credit preference interface **170** enables the users to view and/or update credit preference settings in a clear, simple, comprehensive and intuitive manner. The credit preference interface **170** may be used to view or input/amend the business unit's credit preferences. The credit preference settings are preferably only viewable by users within a business unit, and amendable by users with the correct permissions, both of which may be designated by the financial institution or the business unit. A business unit may also select to inherit credit preferences from another business unit within its family hierarchy.

In a preferred embodiment, the credit preference interface **170** includes a display window **172** that displays various information including an alphabetical listing of all other legal entities (*i.e.*, financial institutions) that have access to the system **10**. Each legal entity can be expanded via an expand button **174** to list the settings for all the credit groups that the user has selected to trade within that legal entity, as shown for the Merrill Lynch entry. For those legal entities that are not expanded in window **172**, the settings displayed are for a designated default credit group **176**. The user can modify the displayed credit groups by selecting the Modify Credit Groups button **178** which launches the modify credit group interface **180**, as illustrated in FIGs. 8A and 8B. The modify credit group interface **180** enables the user to customize his/her class groups by providing functionality to perform such operations as adding and removing instruments from a class group, as illustrated in FIG. 8A. For instance, for a selected credit group **182,** a list**183** of instruments in that credit group is provided. Unassigned instruments can be added and member instruments can be removed. Further, credit groups **182** can be added and deleted via buttons **182, 185**, respectively. In FIG. 8B, each credit group **182** may have bands of maturity **186** defined (*i.e.*, added or deleted). Each class group preferably includes instruments that are closely related because the instruments in each class group are given the same credit preference setting, and therefore, the credit preference setting process may be simplified.

Referring back to the credit preference interface **170** of FIG. 7, a preference setting column **187** provides the credit preference setting designated for the corresponding legal entity **183**. The credit preference settings for any legal entity can be

modified or selected via a drop-down dialog box **188.** From the drop-down dialog box **188**, the user can select from a list of predefined credit preference option. For a new line binary, the user is prompted with a new line binary interface **189** in which the user can enter a maturity. For complex, the user is prompted with a complex preference interface **190** (FIG. 9B) in which the user can enter the exposure for each maturity band.

With reference back to FIG. 7, the complex credit preference settings and the RQ may be provided for each instruments designated as such by selecting an appropriate legal entity and then selecting the Complex Bands button **194.**

If the user does not set a particular preference for a particular counterparty, then the credit preference will be assumed to be a simple binary (no). If after initially setting these preferences a new counterparty is added to the system, the preference for the new counterparty will be binary (no) for all users until they have specifically set a credit preference for the new counterparty.

The level column **196** displays the business unit's designation for each legal entity as to the levels A, B or C. The level set for each legal entity may be provided by the system **10** via various interfaces such as a market detail interface (described below with reference to FIG. 15) to provide the trader with information with regard to the creditworthiness of the counterparty. Thus, a business unit may assign one of the levels A, B or C against each legal entity. This is essentially a quick reference of credit worthiness for the user.

The columns **198** labeled S&P and Moody are industry credit ratings that are integrated into the credit preference interface **170**. The industry credit ratings may be downloaded on a subscription basis via external communication interface link interface **62** (FIG. 2). Lastly, the last modified column and the modified by column identify the time and person that last modified that credit setting. As mentioned before, access to modify any of the credit preferences should be limited to a finance officer or credit officer of the legal entity.

It should be noted that the credit preference settings may be transferred via electron file transfer or inputted manually on-line at anytime, and as often as the user desires. Further, updates may be made for all credit groups and legal entities, or alternatively, updates can be just for individual settings.

In addition, the credit preferences interface **172** includes a BU Info button **202** which, if selected, brings up a business unit data interface **204**, as illustrated in FIG. 10. The business unit data interface **204** enables the users to view helpful internal information about other legal entities. The respective business units define what information is included in the business unit data interface. For example, the business unit data interface **204** of FIG. 10 provides the internal facility number, telephone number, internal reference number, internal net MTM, internal gross MTM, and internal number deals of a business unit. Alternatively, a business unit may include a contact name or other business unit specific data.

Accordingly, the credit preference logic of the present invention can be illustrated graphically as shown in FIG. 11. For purposes of FIG. 11, it is assumed that business unit (i) belongs to legal entity (i) where i=1, 2, and 3, and business unit (j) belongs to LE (j) where j=1, 2, and 3. Accordingly, FIG. 11 illustrates a portion of the credit data which is stored by the system **10** in order to implement the credit preference feature of the present invention. Each column represents the credit preference (*i.e.*, binary, line binary, or complex) which is stored anonymously for each business unit against each legal entity across all credit groups. The vertical and horizontal bars **210** represent the information which business unit (3) requires to determine the credit preference status of an order. The information in columns **210** provides the credit preferences which business unit (3) has set against all other legal entity, and row **211** provides the credit preferences which all other business unit s have set against business unit (3)'s legal entity, that is, legal entity (3). The depth **216** of the graph is divided into the different credit groups such as switch, derivative, and foreign exchange.

The triangles **212**, **214** mark the cells that include the information which is used by business unit (3) to encode a specific order from business unit (5) of legal entity (5) with credit status information for presentation to the user via one or more of the interfaces described herein. In a preferred embodiment, the credit preference feature of the present invention color codes the credit preference status of each order from the perspective of the viewing business unit. Alternatively, another method of encoding the credit preference status of an order may include adding a character notation such as an asterisk or star to an order, as may be desired if the user is color blind.

Each order is color coded according to the credit preferences marked by the triangle **212,** which corresponds to what the order placer's business unit has set against business unit (3)'s legal entity, and the triangle **214**, which corresponds to what business unit (3) has set against the order placer's legal entity. The order is evaluated according to the credit preference defined in the cells marked by the triangles **212**, **214**, and the results can be displayed to the user via the color coding scheme set forth below where true means that the order passes the credit preference of the setting party and false means that the order does not pass the credit preference of the setting party:

Triangle 212	Triangle 214	Color
False	False	RED
False	True	YELLOW
True	False	RED
True	True	GREEN

Thus, each order is color coded to communicate to the user the tradability of the bids and offers in the market based on the preferences of both users. The color coding methodology described herein is used in both the market entry interface (described below with reference to FIG. 12) and the market detail interface (described below with reference to FIG. 15). For the present embodiment of the invention, the following meanings are associated with the cited colors:

GREEN: The price passes the credit preferences of both parties, and the counterparties are free to trade. Any trade that is shown in green can be freely traded by the trader, and credit approval is assumed to be in place.

YELLOW: The price posted is free to trade by the viewer, but the poster of the price has excluded the viewer from his/her credit preferences. If the price is colored yellow, a deal may be allowed provided that the party who placed the passive order allows mutual puts, and the credit over-ride process which is described below is completed. The viewer can attempt to

trade by sending a message (thereby initiating the credit over-ride process) to the poster of the price which discloses the name and/or identity of the viewer, along with a mutual put maturity entered by the viewer. The poster then has the opportunity to accept, accept subject to credit (in either case, the poster may also reduce the maturity of the mutual put), or decline. The poster's name will not be released to the viewer until a trade is executed. The posted price will remain available to all other traders on the system 10 until a trade is completed. If the order trades to another viewer, then the credit over-ride process will be terminated.

RED: The price posted is excluded by the viewer's own preferences even though the poster is (may be) clear to trade. In this situation, the viewer is not free to trade since it is the viewer's own credit preference that the viewer set which is preventing the trade.

BLUE: The price is the viewer's own order.

WHITE: Only used in the market entry interface **250** (FIG. 12) to display prices where there are multiple orders at the best price with differing codes. Thus, the viewer is notified to view the market details interface for more information.

In the over-ride process mentioned above, if the viewer sees a price coded yellow that he/she wishes to trade, then the viewer may activate the over-ride process. The over-ride process begins by prompting the posting party with a request for an order quantity. The message sent to the poster essentially states that the viewer, which is identified by name in the message, wishes to trade a stated quantity and that the receiving party has a stated period of time to respond, for instance, 15 seconds. The viewer will then see a copy of his/her message and a clock which displays the countdown of the stated time to the poster. The poster receives the message and can decline or accept. If the poster declines, then the viewer is informed accordingly. If the poster accepts, then the poster

has the option to add a mutual put maturity and request a small price adjustment, which will be stated in a specified number of months. The viewer cannot back out of the trade while the clock is running (unless a price adjustment is requested). Further, at no time is the poster in a trade until all steps are complete.

The process by which passive orders are color coded is described at this point. Regardless of the credit preference type, the trader workstation **20** generates a maximum maturity value that determines how an order will be color coded. The maximum maturity value is in the form of an integer n digits in length, with the right-most two digits representing days, and the left (n-2) digits representing months. Therefore 12000 represents 10 years, 3600 represents 36 months, and 114 represents 1 month, 14 days. The method by which credit preferences are converted to a maximum maturity value is represented by Table 2 below.

Preference Type	**Maximum Maturity**
Binary No	-2^{31}, the smallest possible integer value
Binary Yes	$2^{32}-1$, the largest possible integer value
Line Binary	The maximum maturity associated with the preference(*e.g.*, Line Binary/12 has a max maturity of 1200)
Complex	The maturity of the highest band with an exposure amount greater than zero.(*e.g.*, The following complex preference would have a max maturity of 6000)
	Mat Band Exposure 100 10,000,000 600 5,000,000 1200 3,000,000 3600 1,000,000 6000 500,000 12000 0

TABLE 2

Every instrument in the system **10** possesses a maximum maturity value. To determine whether a particular order can be traded, the maximum maturity for the order's

instrument is compared to the maximum matusity of the credit preference. If the instrument's maximum maturity is greater than that of the credit preference, then the order may be traded, otherwise it cannot be traded.

Note that the maximum maturity assigned to a Binary-No preference will be lower than that of any instrument, effectively making all instruments untradeable. Likewise, the maximum maturity of a Binary-Yes preference will exceed that of any instrument.

In order to determine the appropriate color code, the trade workstation **20** maintains two lists for each instrument class. One list includes the credit preferences that the viewer has set against all other legal entities for that instrument class. This list may be referred to as MY_PREFS. The other list includes the credit preferences that all other business units have set against the viewing legal entity for that instrument class. This list may be referred to as OTHER_PREFS. Each of these lists contains the following data:

Business Unit ID (Only used for OTHER_PREFS)
Legal Entity ID (Only used for MY_PREFS)
Maximum Maturity
Credit Level (Only used for MY_PREFS)

Consider, for instance, an order for an arbitrary FRA instrument placed by business unit (1) of legal entity (1). When the order is broadcast out to a plurality of traders 20 (*i.e.*, viewers), the order will include the following information:

Business unit of trader placing order: business unit (1)
Legal entity of trader placing order: legal entity (1)
Maximum Maturity of order: 3600 (for example)

In order to color code the order, the viewing party must extract and utilize his/her credit preference against legal entity (1) from the FRA MY_PREFS list, and business unit (1)'s preference against him/her from the FRA OTHER_PREFS list. From the credit

preferences extracted, the color of the order as it will appear to the trader is as defined in Table 3 below.

MY_PREFS **PREFERENCE** max maturity >= 3600	**OTHER_PREFS PREFERENCE** max maturity >= 3600	**Color of Order**
false	false	red
false	true	red
true	false	yellow
true	true	green

TABLE 3

Also, note that the MY_PREFS list may contain a credit level (*e.g.*, which may be associated with the order and presented to the viewer.

Accordingly, when the user logs into the system **10**, the user populates the MY_PREFS and OTHER_PREFS lists for the instrument classes for use by the credit preference module **76** (FIG. 3). This is achieved by the central processing center **12** sending to A trader workstations **20** that is logging-on one or more messages including the MY_PREFS and OTHER_PREFS lists from the database **66** on the hard disk **64** (FIG. 2).

When a user changes a credit preference assigned to a legal entity for a particular credit group in a way which causes the maximum maturity of the credit preference to change, the user will receive updates to MY_PREFS from the central processing center **12**. Also, any user within the affected legal entity who is logged on to system **10** will receive an update to OTHER_PREFS. Changes to complex preferences do not require such an update unless the zero band is changed (thus modifying the maximum maturity). If the user changes the credit level associated with a legal entity, the user will receive an update to MY_PREFS.

However, these two updates should not be performed at the time the changes are made, as doing so could allow a user to determine the legal entity that placed an order by methodically changing his/her credit preferences against each legal entity from a green

state to a red state until the order changed color. Instead, the required updates will be collected and sent out on an periodic basis. Also, to discourage discovery of a counterparty's identity by assigning a unique credit level to a single legal entity, each credit level should be assigned to either no legal entity, or to more than one legal entity.

From the command center interface **130**, a user may enter the market entry interface **250**, as illustrated in FIG. 12. At the market entry interface **250**, the user can simultaneously monitor numerous markets and place orders, including bids and offers. The market entry interface **250** also allows the trader to select any instrument(s) to be displayed, and multiple market entry interfaces **250** with various trading functions (*e.g.*, common FRA on one interface, SWAP on another interface, and Switches on yet another interface) may be opened on the trader's desktop simultaneously. The market entry interface **250** is designed to present the sum of the best bid and ask, and the act of trading by any two parties by a flashing volume indicator in the top right-hand corner. Thus, the market entry interface **250** enables a trader to easily monitor many different markets with relative ease and utility. It should be noted that the system **10** does not perform auto-matching of orders, but allows the user to maintain control of the trading process at all times. The system **10** does this by introducing the concepts of active and passive orders. A passive order is an order placed in the system **10** for a particular instrument, for a particular quantity, at a specific price, for a particular time period (see order types below). An active order is when a user decides to trade a passive order displayed in the system **10**, and is usually only required to provide the quantity. Thus, there can be active or passive bids and offers.

The user may customize the market entry interface **250** by adding and removing instruments (*i.e.*, markets) displayed in the instrument display window **252**. The user may add new markets by entering an instrument symbol (according to the symbology of the present invention) into instrument identifier field **254**. The user may also want to define groups of instruments which can be saved as profiles and viewed together. Profiles allows the user to organize multiple markets by like attributes. The profile being viewed is displayed in the profile display field **256**. The profile display field **256** is a pull down menu that lists the other profiles defined by the user. Until the user defines a first profile, the profile display field **256** is set to default.

Individual markets displayed in the instrument display window **252** are divided into four columns: instrument, best bid, best ask, and info. The instrument column displays the instrument name (*i.e.*, the symbol, alias or a security identifier). The best bid column displays the best bid information, defined herein as the orders that are at the best price. The best bid information includes a relatively large central number that displays the least two significant digits of the price, a bottom left number that displays all but the least two significant digits of the price, a bottom right number that displays any volume or quantity currently trading, and a top right number that displays the quantity of currency units in millions. Depending on the precision desired, a greater or lesser number of digits can be displayed as the larger central number. The precision of the displayed central numbers is defined for each instrument, and may, for example, include 2, 3, 4, or more digits. The best ask column is substantially identical in format to the best bid column, but displays the best asking price rather than the best bid price. The info column provides space for data items that the user may select to view, as defined in an info window **258**. In the present embodiment, three items are defined in the info window **258**, and thus, the corresponding information for the instrument will be listed in the info column.

The system **10** provides users with a symbol construction interface **270**, as illustrated in FIG. 13, that can be accessed via a Lookup button **272** from the market entry screen **250**. The symbol construction interface **270** functions to aid the user in selecting instrument for display in the instrument display window **252**. From the symbol construction interface **270**, the user can view available aliases in window **273**, explode a symbol (*i.e.*, view a list of underlying parameters associated with the symbol, for example, payment date) via the Explode Symbol button **274**, select symbols to be added to a profile via the Add to Profile button **276**, and construct new symbols or aliases via the Build Symbol button **278**. The symbol construction interface **270** also provides error checking such that only valid symbols can be selected. An instrument should exist in the database to be valid, and not all combinations will exist. For additional verification, the symbol explode function of the Explode Symbol button **274** enables essentially all aspects of the instrument to be displayed in detail. Thus, the explode symbol feature provides a complete detailed description of the instrument in Symbol window **280**.

The symbol construction interface **270** screen also enables the user to search for groups of symbols by at least partially filling out the input parameters **282** located above a Search Options button **284**, and then selecting the Search Options button **284**. The input parameters **282** include various non-commercial terms of an instrument that can be negotiated following a transaction. For instance, as shown in FIG. 13, the input parameters **282** include class of instrument, currency, start month, end month, over, FLOPT, and special rules. By at least partially filling in these parameters, the user can search for similar instruments which are displayed in window **280.**

Referring back to market entry interface of FIG. 12, it is noted that the prices displayed in the best bid and best ask columns are encoded with credit information using the color scheme described above. As previously mentioned, color-blind users can have the color coding scheme replaced by a symbol scheme in which different symbols are positioned next to the respective prices to indicate the credit status of the order. The symbol scheme may be chosen by the user under the Environment tab of the preference interface **148** (see FIG. 6B).

It should also be noted that the inventors of the present invention are not presently aware of any electronic trading system that offers color-based credit preference pre-screening such as that disclosed herein. The present invention provides color-based credit preference pre-screening because, unlike the prior art systems which only show the best dealable price or the best minimum quantity, the present invention shows all prices (bids and offers), irrespective of their credit preferences. Thus, the user can be provided with as wide of a view of the markets as the user desires. Advantageously, the color coding enables the user to visually determine virtually instantaneously what bids and offers are tradable based on the credit preferences of the trader and the counterparty.

Once the user has entered the desired financial instruments in the market entry interface **250** via the symbology, the best bid and offers for each of the desired instruments will be displayed in the instrument display window **252**. The best bid and best offer prices display in window **252** are different from many prior art systems because they are the absolute best bid and best offer at the stated quantity. Because of the unique color coding scheme, the user is able to quickly tell whether or not the bid or offer is tradable by him/her. If the user so desires, the user can select a financial instrument with

the pointing device **86** (FIG. 3), such as a mouse, so as to highlight the row in the instrument display window **252** for that instrument. Once the financial instrument is highlighted, the user may perform one of several functions provided for by the function bar **290**, each of which is described below:

EXPL Function: This explodes the instrument symbol into a full description of the contract, and mirrors the confirmation

HIT, LIFT, ORD Functions: These three buttons allow a user to select an instrument and then place a new order, or execute an active order, by hitting or lifting the desired respective bid or offer. The HIT, LIFT, ORD functions can also be carried out by double clicking the mouse in the screen itself.

RFP Function: request-for-price messages are an important tool to allow the market to communicate. If a trader wishes to see a market, a broker will be contacted via the telephone, and the broker will in turn phone other traders to drum up interest. Using the system **10** of the present invention, the same result can be achieved instantaneously by sending an RFP to all registered users. This message may be displayed in the command center interface 130 of other users, informing them of a RFP in the named instrument. In addition, because derivatives traders are often trading more than one financial instrument, and sometimes in more than one currency, derivatives traders will often have multiple passive orders. The present invention provides at least three order management functions to facilitate the canceling or temporarily suspending the order. This may be an important functionality when the market is moving quickly, or if the position of a trader suddenly changes.

XLST Function: This function cancels the last passive order placed by the trader. Therefore, if a user submits an order and immediately changes his or her mind, the order can be canceled without the need to select the order individually.

XALL Function: This function allows the user to cancel all his or her outstanding passive orders in one key stroke.

REF Function: This function allows the user to suspend or place all orders under reference. This is an alternative to canceling orders one by one. For instance, if a user is expecting news that may affect only a few outstanding orders, it may be safer to place all orders under reference, and individually re-release the orders the trader expects not to be affected back into the market.

DEL Function: This function allows the user to delete a market from the profile.

In specific regard to the ORD button in the function bar **290**, a user can submit a passive order by selecting the ORD button. If the ORD button is selected, a passive order interface **294** is provided to the user, as illustrated in FIG. 14A. From the passive order interface **294**, the user can place a passive order such as a bid (*i.e.*, buy) or an ask (*i.e.*, sell). The user enters a price, quantity, and selects how long the order will be good. The price will default to current market level so the user may only need to enter the last two digits of the price. For quantity, the system **10** recognizes m, mm and b for thousands, millions and billions, respectively. The system **10** allows the following order types to be entered under the good until option:

good until logout (default) – Requires the user to be logged on and to monitor the orders status.

good until time– The user will be prompted to enter a time (in his or her own time zone). This order does not require the user to be logged on and will be canceled automatically by the system **10** at the appropriate time.

good until canceled – This order again does not require the user to be logged on, but must be canceled by the user.

The system checks any new orders for reasonableness (or "framing") as they are placed. For example, a bid cannot be higher than the existing offer without the user double checking. The tab key, enter key, or the mouse can be used to navigate through the

passive order interface **294**. Upon selecting the OK button, the order is submitted into the system **10** and the user is returned to the market entry interface **250**.

In specific regard to the HIT and LIFT buttons in the function bar **290**, a user can initiate active orders by hitting a bid (*i.e.*, sell) or lifting an ask (*i.e.*, buy). By selecting either the HIT or LIFT button, a hit order window or a lift order window is presented to the user. For example, a hit order window **296** is illustrated in FIG. 14B. The hit order window **296** is substantially identical to the lift order window. As shown, the hit order window **296** identifies the instrument and order price. Further, the user is presented with a transaction quantity which is initially set for the full amount being offered by the counterparty. The user is allowed to reduce the quantity figure. The user is not allowed at this point to increase the quantity figure because the counterparty has already indicated the quantity they are desiring to sell. Upon selecting the OK button, the order is executed by the system in the manner described below, and the user is returned to the market entry interface **250**.

In addition to the above functions provided by the function bar **290**, if the user wants to see the full depth and breath of a particular market in a particular financial instrument, the user can select (*e.g.*, highlight) an instrument in the instrument display window **252** and then click on the MDS button **292**. This will launch the market detail interface **302**, as illustrated in FIG. 15 for the highlighted instrument.

The market detail interface **302** enables a trader to view essentially all the orders in the market for a particular instrument, both bids and offers. The bid orders are listed in a bid window **304** where the credit levels (*e.g.*, A, B or C), bid quantities and bid prices are provided. The offer orders (*i.e.*, ask orders) are listed in ask window **306** where the ask prices, ask quantities and credit levels are provided. As with the market entry interface **250**, the orders are color-coded with the appropriate credit preferences. This is a significant departure from many prior art systems which only show the best dealable price or blended prices.

In the market detail interface **302**, orders are individually listed in the bid window **304** or the ask window **306** in order of price, and then according to the time the orders were entered into the market. The user has the ability to select any order on the screen and hit or lift the order, assuming of course that the respective credit preferences will

permit a trade. The user is provided with a function bar **308**, which is substantially the same as function bar **290**. Particularly, the buttons of the function bar **308** are substantially identically to those on the function bar **290** except that they only apply to a particular instrument while the buttons of the function bar **290** apply against multiple instruments. Further, a fair price indicator, spot/setting indicator (*i.e.*, the LIBOR for that day), and last traded price indicator are provided along the bottom of the bid window **304** and ask window **306**. The last trade pricing may be replaced by volume, duration, RQ, last close price, etc.

An advantage of the market detail interface **302** is that the user is not restricted to trading only the best price or first order. At no point in the process will any orders be automatically matched against each other by the system **10**. The user is in complete control of the order flow process.

Thus, the user can execute both passive and active orders from either the market detail interface **302** or the market entry interface **250**. At either interface **250, 302**, if the user wants to execute a trade, then the user only need to highlight the desired bid or offer and select the corresponding function button from the respective function bar **290, 308** to initiate the transaction. Although the semantics of placing, changing, and canceling orders can be relatively complex, the user is shielded from this wherever possible by the system **10**.

Each order entered into the system **10** is placed into a queue based on price and time received. A change to the order may or may not affect the order's place in the queue. Any change of price will move the order up or down in the queue depending on the price level. Any decrease in the volume of the order will not affect the order's place in the queue. Any increase in volume will result in the previous amount holding its place and a new order placed for the balance.

Effective electronic trading should be intuitive, fast and reliable. In order to facilitate this, the present invention is designed to maximize a user's efficiency. The system **10** enables the user to place passive orders from either the market entry interface **250** or market details interface **302** using the input device **86**. For instance, the user may double click on the instrument name or may select the ORD button of the function bar **290, 308** in order to launch the passive order interface **294**.

Once an order has been submitted, it will immediately be updated to the market entry interfaces **250** and market details interfaces **302** of other users, providing the user has a current subscription (*i.e.*, field setting) to the instrument.

For monitoring the status of a user's outstanding (or open) passive orders, and for making quick adjustments to those orders, the present invention has a facility known as an outstanding order blotter **320**, as illustrated in FIG. 16. The outstanding order blotter **320** summarizes all outstanding passive orders and provides the user with the ability to confirm the terms of the trade, the symbol, and the type of order. In addition, the outstanding order blotter **320** enables the user to quickly change the price, quantity, or good until status via drop-down menus that appear when an order is selected. From the outstanding order blotter **320**, the user may also place new orders and/or cancel a particular order in the market. Thus, the outstanding order blotter **320** gives the user the ability to manage his/her current passive orders in the market from a single interface. As with the market entry interface **250** and market detail interface **302**, the user is provided with cancel all, cancel last, and refer-all functions via the outstanding order blotter **320**. This is a significant advancement over many prior art systems in that not only does the system **10** offer a facility to track all current passive orders, but the system **10** also enables the user to modify, add or delete passive orders from the outstanding order blotter **320** without returning to the market entry interface **250** or market detail interface **302**.

For executed or canceled orders, the user is provided a client monitor **330**, as illustrated in FIG. 17. From the client monitor **330**, the user has access to completed or canceled trades. Thus, the client monitor **330** enables the user to quickly see what orders have been executed or canceled, and to look back over time to see pervious days trades. Preferably, historical transactions will be available for one month via the client monitor **330**.

The outstanding order blotter **320** and client monitor **330** enable a user to manage his/her diverse trading activities. From either blotter, the user can monitor the status of orders and executed or canceled trades. Both of the outstanding order blotter **320** and client monitor **330** can be accessed from the command center interface **130**. Further, the blotter **320** and monitor **330** are updated automatically if the user submits an order via one of the other interfaces.

The system **10** permits active orders (*i.e.*, those where a trader hits or lifts a passive order) to be placed from either the market entry interface **250** or market detail interface **302** via the HIT and LIFT buttons on the function bars **290, 308**. The system **10** differs from many prior art systems in that two passive orders will not be executed against each other automatically. An active order from an active user is required for execution. Furthermore, there will be one active and one passive user for each trade. This means choice (where bid equals order) or even backwardation (where bid is higher than order) markets are possible. Accordingly, for a transaction to be completed in the system **10**, an action must be performed against a passive order.

Once an active order has been placed in the system **10**, the execution process is completed. An execution notification message **340**, as illustrated in FIG. 18, is sent to both counterparties, describing the transaction and disclosing the names of the counterparties. Note, this is the first point in the transaction that the counterparties are identified to one another. The system **10** ensures that both users receive the message before the trade is finally completed. This does not require any form of action from either user, the market interface module **74** (FIG. 3) of each trader responds for the respective user. This validation ensures that, in the unlikely event that a connection is lost during this process, a user does not have a position of which he or she is unaware.

The system **10** is designed to ensure that a user cannot execute a passive order which has been canceled or is no longer available. This is done by checking to verify that the connection between all trading counterparties is live at all times. In the event that the connection is lost or broken, all orders from a user which loses connection to the system **10** are automatically suspended. Following the execution, the client monitor **330** is updated with the transaction.

The execution notification message **340** (FIG. 18) provides the users the opportunity to increase the quantity of a trade once an initial trade has been executed. One of the users can insert a quantity in the will-do-more field **342** which represents an additional quantity to the original amount. This feature is designed to enable a user who has a large quantity to trade to place a passive order for just a smaller portion initially. Users often want the ability to increase the quantity of an order when they have a large quantity to transact. This is because large orders in the market often tend to adversely

move the price of the market as market participants back off such large size. The ability for the passive trader to conduct an anonymous dialogue via the system **10** for increasing the size of a transaction after an initial transaction for a smaller size has been executed is an additional difference between the system **10** and many prior art systems. In operation, once an amount has been entered into the will-do-more field **342** and the Submit button **344** selected, the counterparty is provided with the request for more. The counterparty is given a discrete period of time to respond to the request to do more, after which the request lapses. If the counterparty wants to trade more, then the counterparty can accept the amount requested, reject the amount by selecting the Reject button **346**, or the counterparty can request a different amount that is then present back to the user who then has a discrete period of time to respond. The counterparties can exchange offers to increase the quantity as many times as they desire until an addition amount is agreed upon or a decision is made not to do more.

This function should preferably be made available only if the active order clears the full market size at the current best price. In that case, either party may ask to do more. The will-do-more feature enables the counterparties to increase the size (amount of the trade), but not the price. The price is preferably not affected. This process can go back and forth for some time and can continue as long as the will-do-quantity is fully accepted (*i.e.* can occur more than once). Once completed by both parties, the system will combine all will-do-more quantities and generate only one transaction ticket for the total increased amount at the initial price.

Following the execution of a trade, the system **10** enables the parties to negotiate the non-commercial terms of the transaction. This process is referred to as term negotiation, and is effectuated through the negotiation window **350,** as illustrated in FIG. 19. The term negotiation process is a process where by both parties to a trade have the ability to negotiate non-commercial terms of a transaction. In addition to the commercial terms, such as price, quantity, etc., derivative transactions also have non-commercial terms which do not affect the price of the trade. While there are defaults, the parties may want to negotiate these terms. Once a trade has been executed, the system **10** will present the parties with the option to negotiate via interface **350**. The system does not force a party to complete this process immediately, however, as the party may have other more

important tasks to complete elsewhere. The negotiation should, however, be completed within a reasonable time. The active party (*i.e.*, the trader that hit or lifted the order) will be presented with the terms **352** to be negotiated, current values **354** which are editable (such as by a text field), and default values **356** which are predefined in the system. The trader may accept the system defaults by selecting button **358**, or enter his/her own desired values and select the submit button **360**. These values are sent to the passive trader (*i.e.*, the trader that placed the order in the system originally) who may also accept or enter his/her desired values. If an agreement cannot be reached, then the defaults will be used. The status of these negotiations will be displayed in the client monitor **330** of FIG. 17.

Once a trade has been executed and the non-commercial terms have been negotiated, a trade confirmation is sent automatically to the settlement contact of both business units preferably via fax. The system **10** can also send the confirmation via file transfers, e-mail, or any other suitable means of communication. Preferably, the trade confirmation includes the quantity or volume traded, identification of the financial instrument that was traded, price, date and time the execution is recorded, and a settlement ID that uniquely identifies the transaction. However, it is recognized that various other parameters and transactional data can be included as appropriate for the nature, type and subject matter of the transaction.

In addition to the interactive trading functionality described herein, the system **10** also offers traders a trading methodology for dealing with risk management problems unique to interest rate swap dealers. In particular, over the last few years, a new market has emerged as a result of interest rate swap dealers' need to better manage their risks associated with changes in interest rates on their growing interest rate swap portfolios. With these markets becoming more competitive, bid-offer spreads are narrowing considerably. This factor, combined with the wide spreads of exchange traded Eurodollar futures, has contributed to the use of exchange traded contracts for hedging short-term risks being expensive and sub-optimal. As a result, the switch was created. A switch is simply the simultaneous purchase and sale of a pair of similar forward rate agreements. This instrument, and the mutually offsetting need of a pair of derivative portfolio risk managers, provide an improved risk management tool for a large portfolio of interest rate

swaps. Despite the obvious advantages and demand from risk managers, as a result of the complexity and time-consuming nature of completing a transaction, the switch market has grown relatively slow. This may be because risk managers are very wary of disclosing the exact nature and size of their own portfolios. Therefore, finding the counterparty that has the opposite need is often difficult.

Typically, a dealer prepares a fax listing the days that the dealer needs to buy or sell, but not the amount or importance of any given date. The dealer sends the listing to other risk managers at other firms, or to voice brokers. From this bit of incomplete information, transactions are eventually negotiated. While finding switches may be important, it is usually not urgent as compared to other more immediate tasks, such as new executions or the hedging of large outright market risks. As a result, the time is never quite right to focus on a position that may be heavily weighted on one side and matches another's position, but not perfectly. Voice brokers have tried to solve this by matching multiple faxes, but this does not appear to be the solution.

The present invention goes several steps beyond these efforts, and offers matching with the credit preferences of the traders taken into account. The system **10** also demonstrates fairness in any matching process. When the portfolios are so large that each risk manager has a position on each day out over the life of his or her portfolio, the resulting combinations can be huge. The rules, constraints and priorities are preferably structured in a way to demonstrate fairness of execution between users to the market participants.

In a significant departure from known attempts by others, the present invention offers traders a solution to the complexities of switch trading by creating an anonymous position discovery system called the switch engine. The objective of the switch engine is to put a tool in the hands of risk managers that allows them to perform anonymous switch transactions fast and efficiently without losing control of the process. The switch engine achieves this by having the trader manually input his/her position (*i.e.*, interest rate risk portfolio) into the switch module **80** (FIG. 3) via a portfolio interface **380** using variable rate index and currency for up to 180 days or more into the future, as illustrated by FIG. 20. Once a portfolio is inputted, the user must confirm its accuracy by selecting the

Apply button **381** before the positions can be used in the switch mechanism **35** of the central processing center **12** (FIG. 2).

In addition, the system **10** can be configured to receive the position data via electronic transfer or some other suitable form of data transfer. This may include a transfer directly from the user's own risk management systems. Although some trader workstation **20** may need some customization to receive portfolios in this matter, the system **10** should support this capability. The nature of switch positions, particularly in the near term (defined as out to the maturity of each index), is relatively stable, and therefore, the on-line entry of portfolios by the user should be adequate for most traders. The inputted portfolio data is then sent from the trader **20** workstation to the switch mechanism **35** of the central processing center **12**.

With reference to the portfolio interface **380** of FIG. 20, an inputted column **382** represents the portfolio entered by the user, the traded column **384** is the cumulative amount traded by the user since the portfolio was entered in the inputted column **382**. The net column **386** is the real-time position of the user given the portfolio inputted and the traded quantities in column **384**. The user may restart at any time by rolling the net positions in net column **386** into the input column **382** by selecting the Roll button **388**, or by clearing all the positions by selecting the Clear button **389**.

Once the position is inputted in the system **10**, a switch interface **400**, as illustrated in FIG. 21, is generated by the switch module **80** using his/her own position data from other traders entered on the respective trader workstations **20** and uploaded to the switch mechanism **35**. The switch interface **400** enables the user to search through the market, and view possible trading combinations of his/her portfolio and combinations of his/her portfolio against positions from other counterparties which have been input into the system. This is referred to as position discovery. The switch interface **400** can be reached by selecting the switch engine button in the tool bar **132** of the command center interface **130** (FIG. 5). For a given floating rate index (for example, a one month LIBOR) **402**, the switch engine interface **400** lists the net positions **404** for each day **406** out 180 days. In addition, the possible switches **408**, available switches **410**, formulated forward rate **412**, and a fair price **414** are also listed for each day **406**. By selecting a day **406**, the switch interface **400** displays all possible switches against that day. Thus, the

user can pick the days for which he/she is carrying the most risk. An advantageous feature of the switch interface is that the user is provided with only combinations where he/she has a position and someone else has the opposite position, and both parties satisfy each other's credit preferences as described above.

The net position **404** is the position entered or modified by the user. Possible switches **408** are those switches for any given day with respect to the trader's own position. Note, a switch typically makes sense only if the trader's position is long one day and short on another day.

The available switches **410** are positions in other counterparty portfolios that exactly offset the position of the user. Note that the switch interface is configured to displays available switches up to the size of the user's own position, and preferably does not disclose the name(s) of any counterparties until after a trade has been completed. This ensures the anonymity of the user, and does not disclose any material position data to other traders.

The forward rate **412** is the current market forward rate calculated by the system from other available market rates for the given date for the maturity of the underlying index maturity. The fair price **414** represents the relative price between the two underlying FRAs, which is the basis upon which forward rate agreements are traded. The fair price **414** is calculated from live market data taken from other financial instruments. While not designed to execute trades at the displayed fair price **414**, the fair prices are an aid to users in gauging the fair value of the market.

Once a user has found a switch that matches the needs of the user, that is shown as an available switch **410,** then the user may send a request for switch message by selecting the request for switch (RFS) button **416**. In response thereto, an RFS message is sent anonymously to only the other counterparties of the selected offsetting positions. Anyone of the receiving counterparties may then add the symbol automatically into a market entry profile by selecting (*i.e.,* clicking on) the message and completing the transaction utilizing the market entry interface **250**, as described herein. Upon completion of a switch by the switch mechanism **35**, the portfolio's of the counterparties are automatically updated to reflect the switch. In accordance with a feature of the switch engine, switch transactions can be accomplished in real-time.

As an example of a switch, a trader viewing the switch interface **400** may select (*i.e.*, highlight) the "Thurs., Aug. 21" position, and then select the RFS button **416**. The passive order interface **294** (FIG. 14A) then prompts the trader with a quantity and price which the trader may modify. The trader may then submit the request for the switch. All anonymous counterparties that have an offsetting position then receive a message in command center interface **130** (FIG. 5) notifying the counterparty of the anonymous request for a switch. Any one of the counterparties may then select the request message which causes the request to be displayed in the market entry interface **250** (FIG. 12). From the market entry interface **250**, the counterparty can hit the request for switch or submit their own passive order.

The trader can update or modify his/her portfolio by selecting the Update button **418**, which launches portfolio interface **380**, as described above. The trader can then select an inputted amount **382** or a traded amount **384** to enter or edit the displayed values as desired.

It should be noted that the present invention has application in financial markets other than derivatives. For instance, in the inter-dealer market, a switch or swap may be a desirable means by which a risk or inventory short fall is off-set. In particular, a security may be borrowed or an open derivative position hedged with another position. For instance, in the U.S. Treasury bond market, it is conventional for traders to buy and sell securities, and to hedge with the newest or benchmark issues. The U.S. Treasury may issue new two year securities each month. For the first month, the new issue is the benchmark (or on-the-run) issue, and the other issues with a final maturity between one and two years are referred to as old issues. If a trader is asked to buy an old issue, then the trader will sell the on-the-run as a hedge since the on-the-run has the liquidity. Over time, the trader will most likely need to sell the old issue and buy back his/her hedge. A switch with another dealer that has an opposite position provides cost and risk effective method of effectuating such a trade.

However, the unwillingness of traders to disclose their position has made bond switches difficult. Thus, the switch engine of the present invention is a solution. The principals of the switch engine can be successfully applied to bond switches, as well as other financial instrument switches. The switch engine interface **400** may need to be

slightly modified wherein the instrument designation **402** is changed to reflect the new market, for instance, to Two Year U.S. Treasuries or 30 FHLMC TBA. Further, the setting column **406** may be changed to reflect the individual securities which may be switched, and the remaining columns should not need to be changed. However, a new column representing the duration of each security displayed should be added so that the securities can be duration weighed to ensure fairness.

In addition to the switch engine, the system **10** provides trading methodologies referred to as the auction and switch auction. Although auctions are held in a variety of markets, some of which are electronic, the auction and switch auction have no known counterpart in the derivatives markets. The auction and switch auction trading methodologies were developed in order to provide an auto matching process for switches. However, the system **10** can use these auction methodologies for auto matching for a wide variety of other financial products, not just switches.

Unlike traditional auctions, where once a trade is completed the counterparties are free from future financial commitments, with derivatives trading, the counterparties may end up with multi-year financial commitments to one another once a trade is executed. In order to deal with this relatively unique problem, the auction and switch auction take the credit preferences of the users into account. The auction methodologies herein are referred to as a two way Dutch auction with credit. In conducting such an auction, users submit orders into the auction module **81** of the trader workstation **20** (FIG. 3) which communicates the information to the auction mechanism **34** of the central processing center **12** (FIG. 2). The orders are submitted via an auction interface **430**, as illustrated in FIG. 22A, by price, quantity, and action.

With reference to FIG. 22A, the auction interface **430** includes a queued orders window **432** into which the user enters an order, and a submitted orders window **434** which shows the orders submitted to the auction mechanism **34** via the auction module **81**. Orders can be added via the Add button **436**. Orders are moved from the queued orders window **432** to the submitted orders window **434** by highlighting the order and then selecting the Submit button **438**. All entered orders in the queued orders window **342** can be submitted at once by highlighting all the orders and then selecting the Submit

All button **442**. Prior to submitting an order, the orders in the queued orders window **432** can be edited via the Edit button 440 or canceled via the Cancel button **444**

In accordance with the auction, the orders are filled at their entered price or better, and between counterparties that satisfy the credit preferences of one another. The auction mechanism **34** then conducts the auction, preferably utilizing the following constraints and priorities to ensure fairness.

The auction price is calculated by finding the price at which the most volume is traded. This condition is sufficient to generate a fair price, and all transactions should be completed at this price. It is noted that this price is generated without taking credit into account. The matching of orders is completed to ensure that credit preferences (including complex rules) are safe guarded and to ensure that the minimum number of tickets are generated. The better submitted prices will have priority, and all orders at the auction-price are filled in proportion to each other. Under these constraints, the auction mechanism **34** executes the auction, matching users and generating a settlement list. The settlement list comprises the trades resulting from the auction.

The confirmation process is substantially the same as that for interactive trades. The system **10** notifies the users of their fills. Finally, results will be made available to the user via a message to the command center interface **130** of each user.

In addition to the general auction facility described herein, the present invention also offers a dedicated limited auto-matching process for switches referred to as the switch auction. The switch auction does not have to be a full auction, in that the price may be set by the system **10**. The price will, however, be available before the commencement of the matching. This will allow all users to understand the levels that will be used before entering into the switch auction. This also allows the users to maintain control of their positions.

As with the general auction, the positions of each trader are loaded into the system **10** utilizing a switch auction interface **460,** as illustrated in FIG. 22B. The switch auction interface **460** has two parts, an auction list **462** and an auction status **464**. In the auction list **462**, various auctions and their respective statuses are listed by FLOPT and currency. In the auction status **464**, the auction selected in the auction list **462** is displayed and identified (including the open and close day/time). The positions **466** for

respective dates **468** are entered by a user, and do not need to add to zero, but should include positions of both signs (*i.e.*, long and short). The rate **470** is the price at which the auction is conducted. The rate **470** is displayed a predetermined amount of time before the auction is conducted so that the participants have the opportunity to step out of the switch auction if they so desire. The rate is preferably based on available market factors, and may be calculated by a calcserver (as described below). The results column **472** is the total trade amounts resulting from the auction. The amount displayed in the results column **472** for a given date may be the cumulative amount from multiple transactions with multiple parties. Additional control buttons **474** enable the user to submit an order, cancel an order, cancel all orders, or change an order. The switch auction will auto-match the position, taking credit preferences of the users into account so that (1) a maximum volume is executed and (2) a minimum number of tickets is generated.

The switch auction utilizes the above two rules to ensure fairness. No user will be given priority over any other user except as required to satisfy the respective credit preferences. Preferably, only two-way switches will be offered. Switches are a risk management tool, and switches generated between three counterparties introduces substantially more credit risk than a straight two-way switch.

At this point, the calcserver which calculates the auction rate and price information, and other relevant data for operation of the system **10** is described. The calcserver provides the switch mechanism **35** with the forward rate for any given index for each day, the system price quoted in the market entry interface **250**, and OTC derivative prices derived from the yield curve. The calcserver comprises a preprocessor, a zero curve server, a FRA server and a Swap server. The preprocessor gathers real-time data from outside data vendors (such as Reuter or Telerate) and from internal system sources (such as data normally entered into system **10**), and prepares the data for processing by the other components of the calcserver. The zero curve server reads in the market rates (including price and yield for a variety of class instruments such as money market rates, swap rates, future prices, swap spread, bond yields and FRA's) as provided by the preprocessor, and generates therefrom the zeros and discount factors for each currency and level of credit. In particular, a zero coupon yield curve (*i.e.*, zero curve)

comprises a set of points representing the calculated interest rate or discount fact from observable market rates across the term structure (*e.g.*, 0 to 30 years) such that any cash flow can be discounted to today in one step without the consideration with decompounding. Thus, there is a different zero curve for each index/currency pair. The FRA and Swap servers are instrument specific servers that calculate forwards, RQ (as defined above), durations and fair prices.

By way of example, the zero curve calculation starts from the instruments with the shortest term structure in the money market rates (MMs). The analytics for finding points on the zero curve from MMs are as follow. The processed price of the MMs, end date of the MMs and the basis of the MMs (number of days in a year that the MMs is based on) are needed. All of these are stored in a database **64** (FIG. 2). The processed price is the only input that typically changes. The calculation represented by the equation below will generate a new zero rate with the date of the end date of the MMs. The result will be a new zero point which will be added to the rest of the generated zero points. The following equation for Z(t) is the zero rate at the end date of the MMs:

$$z(t) = \left(1 + R_{mms} * \frac{t}{mmsBasis}\right)^{365/t} - 1$$

where Rmms is the processed price of MMs, and t is the time in days between the end date of the MMs and the current date.

After the MMs, the next instruments used according to term structure are either the futures or FRA's. Since the futures and FRA's have similar term structures, a choice will be made on which ones to use. Initially the futures will be used because they have high liquidity. However, it is believed that when FRA's traded on the system **10** reach a high level of liquidity, they should be used instead.

When calculating zero points from the futures, the processed price, the future basis (number of days in a year that the future is based on), the start date of the future, the end date of the future and the zero point of the start date are needed. This data about the future will come from the preprocessor which is used to represent the future. The zero point at the start date is found from previous zero points through interpolation. The following equation for z(e) is the zero rate at the end date of the future.

$$z(e) = \left[\left(1 + \text{futRate} * \frac{e - s}{\text{futBasis}}\right)(1 + z(s))^{s/365}\right]^{365/e} - 1$$

where *futBasis* is the number of days in a year that the future is based off, *futRate* is the processed price of the future, e is the end date minus current date, and s is the start date minus the current date.

The calculation of the FRA zero points is the same as for the futures except that the processed price for the FRA and the FRAbasis are used instead of the processed price for the future and the futurebasis. The information about the FRA will come from the preprocessor. The following equation for $z(e)_{fra}$ is the zero rate at the end date of the FRA:

$$z(e)_{fra} = \left[\left(1 + \text{fraRate} * \frac{e - s}{\text{fraBasis}}\right)(1 + z(s))^{s/365}\right]^{365/e} - 1$$

The rest of the zero curve will be derived from swap information. For the first swap, the zero curve and the discount factor at each coupon date are used to calculate the zero rate and the end date in the swap using the equation below for $Z(t_n)$. When calculating other swap zero points, gaps may exist in the zero curve. Synthetic swap rates are calculated where gaps exist to improve accuracy. The calculation of a normal swap rate and a synthetic swap rate are the same. The following equation for $Z(t_i)$ is the zero rate at the particular coupon date:

$$Z(t_n) = \left[\frac{1 + swapRate * Y(t_{n-1}, t_n)}{1 - swapRate * \sum_{i=1}^{n-1} \frac{Y(t_{i-1}, t_i)}{(1 + Z(t_i))^{t_i/365}}}\right]^{365/t_n} - 1$$

where swapRate is tradePriceAdjust, t_i represents a coupon date, and $Y(t_{n-1},t_n)$ is the period in years between the two coupon dates. Once the trades have been executed and the term negotiation process completed, the system will initiate an automatic confirmation process which, in an embodiment of the present invention, will follow existing market practices. Accordingly, the system **10** will automatically send a fax

confirmation message to each counterparty detailing the transaction. The faxes should be sent immediately after a transaction is completed. The confirmations should follow a unique format, allowing the automatic transfer of these confirmations electronically.

This confirmation has been specially developed to allow for a standard format covering all classes of financial contracts. The standard confirmation follows the following format:

Section 1: Summary of the transaction.
Section 2: Counterparty details and commission.
Section 3: Transaction details.
Section 4: Term negotiation

This provides the users with adequate information to identify and/or record the transaction. The conformation, however, may be sent to the traders any number of ways such as via e-mail, voice-mail, United States Postal Service, or commercial carrier (*e.g.*, FedEx, UPS, *etc.*). Further, it is noted that the information provided can take many other formats within the scope of the present invention.

While the various interfaces to system **10** have been described herein as individual windows, it is noted that multiple windows can be integrated to form a main screen **480** with multiple frames, as illustrated in FIG. 23. For instance, a tools area **432** provides the trader with a set of customized tools including graphs, market quotes, bond prices to yield converters, pricing tools, and MarketSheet™ applets. A service area **484** provides various interfaces as described above on a temporary basis. A message center **486** displays the most recent RFP, RFS, Chat and administrative messages, and is preferably configured as a drop-down window to display multiple current messages. A status bar **488** displays user status information. A workspace area **490** provides for the entering of data into dialog boxes in a non-intrusive manner, plus the execution of the data function. A warehouse area **492** stores the most commonly used interfaces in a tabbed format, allowing the trader to retain their preferred set-up between sessions. Accordingly, the main screen **480** provides enhanced functionality by integrating multiple interfaces in a single window.

IV. Operation

As described above, the system **10** comprises the central processing center **12** that may includes multiple servers connected via an Internet-protocol network to the individual counterparties trader workstation **20** which may be desktop computer workstations. Because of the open system architecture of the system **10**, the present invention may run within the context of the internet browser **72** on the user's existing desktop computer **20**. The desktop computer **20** preferably includes an operating system platform for which a Java-enabled Internet browser is available.

In order to provide the counterparties with anonymous credit preference based trading capability for a wide range of financial contracts where each side enters into a long-term contract with the others, the present invention is designed to be flexible enough to reflect several different measures of credit risk, as generally described below with reference to FIG. 24.

With reference to flowchart **502** of FIG. 24, each business unit (counterparty) provides the group server **32** (FIG. 2) with detailed credit preferences for each potential counterparty business unit's legal entity. The group server **32** then distributes the credit preference information in an anonymous format to the trade workstation **20** which uses the credit preferences of each active business unit (counterparty) in the system **10** to prescreen the user's market orders (bids and offers) against the other counterparties' market orders. Thus, the credit preference module **76** (FIG. 3) of each trader receives the credit preference information defined by a first user with respect to a second user, as indicated by block **504**. The credit preference module **76** then receives the credit preference information from the second user with respect to the first user, as indicated in block **506**. The credit preference module **76** then determines which orders, on which financial instruments, and with which counterparties, the user can deal. This information is coding on the posted prices utilizing color or another notational method such as symbols, as indicated in block **508**.

In accordance with an aspect of the present invention, the prescreening is a complex check to determine whether two particular counterparties will accept each other

for a particular class of financial instrument, for a particular amount and for a particular maturity. This is a risk equivalent measurement, and is more than a simple yes/no preauthorization matrix. More specifically, because each financial instrument has different credit qualities, it is possible for a particular counterparty to be willing to accept another particular counterparty for one type of financial instrument but not another. Furthermore, it is also possible that a particular counterparty may accept the other for a particular financial instrument, but only for a certain length of time (*i.e.*, maturity). The system **10** may also allow the user to accept counterparties for different amounts at different maturities.

It is further noted that the system **10** divides counterparties into legal entities. These legal entities may be further divided into individual business units. So, for example, Bank A may be a legal entity (counterparty) and Bank A might have a different business unit in three different cities (*e.g.*, Tokyo, London, and New York). In this example, the counterparty credit information is available at the legal entity level. So, for instance, if Bank A wishes to allow each of its business units to set their own credit preferences for other counterparties, then these credit preferences will be listed against the legal entity level of all the other business units. In other words, business unit A at Bank A can not say it will trade with desk A of Bank B but not desk B of Bank B. The system **10** allows business units within a particular legal entity to inherit the credit preferences from other business units in the same legal entity family, if so desired.

Once each business unit has inputted their individual credit preferences, this credit preference information is maintained locally at the inputting trader workstation **20**, and transmitted to the group server **32** of the central processing center **12**. The central processing center then transmits a vector of encoded credit preference data to each user logged on, wherein the data represents that preferences of the user to the other legal entities and the preferences of other business units to that user's legal entity for the affected instrument classes. The encoded vector of credit preference data is accessible to any of the trader workstations **20** in the system **10**; however, the sensitive credit information of other counterparties is not available.

Once the user has inputted his/her business unit's credit preferences, the user is then able to select or filter messages on which financial instruments and in which

currencies the user wishes to receive updates, messages and prompts. The filters can be selected via the user preference interface **148** to customize the order information presented by the command center interface **130**. This screening capability is provided to the user in order to prevent him from being overwhelmed by, and to sort through, the possibly thousands of different financial instruments in up to or more than 14 different currencies that the system **10** has the ability to handle. Once these filters have been inputted into the system **10**, the user is able to view trading information on the currencies and financial instruments that have been selected for the user. This means, for example, that if the user has selected US dollars only, then the user will preferably not see information on the Japanese Yen financial instruments which are in the system **10** for trading.

Once the trading preferences of the user have been entered into the system **10**, the user can proceed with trading. The user then activates the fully customizable, re-sizable market entry interface **250**. The market entry interface **250** enables the user to input many different financial instruments which the user is interested in trading on one screen, and have any number of profiles wherein each profile is a collection of markets or a collection of financial contracts in the system **10**.

A preferred embodiment accomplishes the inputting and referencing of the various financial instruments through the use of a unique set of symbols referred to as symbology. The symbology of the present invention is based on a concept of subject based addressing whereby the user creates a symbol to uniquely define any one of many complex financial instruments. The symbol denotes the financial instrument's parameters and attributes. The standardized symbology of the present invention is designed such that the users of the system **10** will recognize the meaning of the symbol when the users view the symbols. To further help the users understand which financial instrument they are trading, a symbol may be identified by the full subject name, an alias (in the case of the most commonly traded instruments), or a unique identifier (***e.g.,*** such as a numeric code). In order to help the users use the symbology to properly express the financial instruments they want to trade, the system **10** allows the users to construct symbols utilizing the symbol construction interface **270** (FIG. 13).

The symbology of the present invention, as described below and as illustrated flowchart **510** of FIG. 25, enables a user to input data including a proposed trade of a financial instrument, wherein the financial instrument is advantageously defined by symbology comprising a source field, a class field, a symbol field and a currency field, as indicated by block **512**. This abbreviated format for identifying a financial instrument can then be easily transmitted to other users within the system **10**, as indicated by block **514**. At the receiving users trader workstation **20**, the proposed trade can be viewed by the traders utilizing the symbology, as indicated by block **516**. By defining the financial instrument using the symbology of the present invention, the users can exchange a small amount of data that is translatable into a detail description of a financial instrument that is relatively complex. This reduces communication and processing overhead of the system **10** and simplifies the user's efforts.

Once the orders have been inputted via the symbology, the market entry interface **250** displays the best bid and best offer for each instrument, as well as the sum quantity available to trade at the best price and other relevant information. The order information (*i.e.*, the bids and offers for each instrument) is coded with the relevant credit preferences, unless several prices are currently posted at the same price but have different credit status, in which case the market detail interface **302** should be used. This is significantly different from some prior art systems which only show the best dealable price. The system **10** presents the best price, irrespective of credit preferences or credit limits. From market entry interface **250**, it is possible for the user to execute a trade directly if the credit preferences of both parties permit. The user may also place a passive order from the market entry interface **250**.

The user also has the option of activating a market detail interface **302** which enables a user to see the complete picture (*i.e.*, depth) of all the orders (*e.g.*, bids and offers) available on a particular financial instrument, coded with credit preference information. The market entry interface **250** and the market detail interface **302** not only display the best bid and offer, but each individual order in the system **10** individually. Through the market entry interface **250** and the market detail interface **302**, the user is provided the ability to select not just the best bid or offer, but any bid and offer in the system **10**. This is important because for credit reasons, the viewing counterparty may

not wish, or may not be allowed to, trade a particular bid or offer. This means that the best bid or offer in the system **10** is not necessarily the best bid or offer available to that counterparty.

The credit preference information entered in the system **10** by each user, as described above, is used by both the central processing center **12** and the transmitting business unit servers **18** to prescreen the bids and offers, and to market orders in the system **10** before they are viewed at the trader workstations **20** of the respective client sites **14**. The sensitive credit preference that indicates which counterparties are acceptable, and under what terms, is preferably maintained at the transmitting trader workstation **20** and the central processing center **12**. The other viewing users do not receive or have access to the credit information of the other users. At the receiving business unit's server **18**, a check is performed to determine whether the receiving client site **14** will accept the particular bid or offer from the transmitting legal entity. The summary and relevant data is transferred in an encrypted form to trader workstations **20**. The credit check may be re-performed at the time of a transaction by the central site **14** and/or the central processing center **12**.

The credit preference screening of the present invention enables the display of all passive orders in the system **10** and their relevant credit status with regard to the viewer on both the market entry interface **250** and the market detail interface **302** as follows: 1) green - this means that the viewer accepts the posting counterparty, and the posting counterparty accepts the viewing counterparty; 2) yellow - this means that the viewing counterparty will accept the posting counterparty but that the posting counterparty will not accept the viewer; 3) red - that the viewer will not accept the poster; 4) blue - that the bid or offer being looked at is the viewer's own; 5) white - used on the market entry interface **250** to denote when two or more orders are placed at the same price but with different credit preferences. The use of color coding enables the system **10** to preserve the anonymity of the users while still enabling the viewing business units to receive credit information about the bids and offers they are viewing. In the event the user is color blind, the system **10** also includes the option to display small symbols next to each price to indicate the relevant credit status to the viewer.

If the viewer wants to trade a green bid or offer, then the system will permit this to be executed right away. Further, if the active counterparty to the transaction, that is, the viewer who hit the bid or lifted the offer, chooses to execute the full size of the amount on offer or bid and there are no more orders at the same price, the viewer will be prompted with the ability to ask the other counterparty to do more. This will-do-more feature is preferably restricted to a predetermined time-limit in which the receiver of the request must respond. The receiver of the request may agree to accept the increased quantity (or part of the increased quantity) at the previously agreed to price or the request will lapse. The will-do-more feature may be repeated as many times as the users desire. The will-do-more feature does not necessarily check credit preferences once this process has begun because both users know the identities of each other at this point. This forces the users to take responsibility for further credit approval beyond the point of the initial trade amount.

If the order being viewed by the user is yellow, then the viewer will accept the poster but the poster will not accept the viewer. In this case, the system **10** enables the viewer to send a credit override message to the poster of the bid or offer whereby the sender of the credit override reveals his/her identity to the poster and asks the poster to reconsider whether or not the poster will do the requested trade with the viewer. In this case, the user which sent the credit override will be identified to the poster, but at no time will the sender of the credit override find out who they revealed themselves to. If the poster chooses to accept the credit override, then the poster may also choose to impose additional credit requirements on the viewer in order to accept the transaction. These additional credit requirements would be in the form of a standard mutual put clause in the confirmation of the trade. The viewer will have the opportunity to either accept or decline the additional credit requirements. The credit override function does not in anyway change the credit preferences which each user previously input into the system **10**. The credit override is preferably on a per-transaction basis.

If the bid or offer viewed by the viewing trader is in red, then the viewer will not accept the poster. Despite the fact that the viewer knows he/she will not accept the poster, the viewer does not know which among the counterparties he/she will not accept is the poster. The viewer is thus not able to identify the poster, preserving the anonymity

of the system **10**. If the poster does not activate the credit override, then no trade will be able to take place.

If the bid or offer displayed is in blue, then the order is the poster's own order. The system **10** does not prevent different users within the same client site **14** from trading with each other.

From both the market entry interface **250** and the market detail interface **302**, it is also possible for the user to send a request-for-price message to the other counterparties that are interested in the requested financial instrument. The request-for-price enables a user to anonymously broadcast to other interested market participants.

With reference to FIG. 26, a flowchart **520** generally describes the steps of a trade. Initially, the first user and the second user are provided with essentially real-time order information regarding more than one financial instrument typically via the market entry interface **250**, as indicated by block **522**. The order information preferably includes a request to buy or sell a financial instrument such as an OTC derivative. At block **524**, one of the first or second users initiates the trading process on an order selected from the order information provided by the other of the first or second users. The credit preference information of each user is then used to verify the trade eligibility of the first and second users with regard to one another based on the selected order, as indicated by block **526**. One or both of the first and second users are then able to request an increase in the quantity of the order, as indicated by block **528**. If an increase is requested, the request is process at block **530**. Alternatively, if there is no request to increase the quantity at block **528**, it is then determined that block **532** if there is a request to negotiate terms of the order, and more particularly, the noncommercial terms of the financial instrument underlying the order. If there is a request to negotiate terms by one of the users, then the request is processed at block **534**. If there is not a request to negotiate terms, then an acknowledgment is sent to both users signifying the execution of the trade, as indicated by block **536**.

The trade process as described above with reference to FIG. 26 can also be described from the perspective of the first and second users. For instance, with reference to FIG. 27A, a flowchart **540** generally depicts the steps of a trade from the perspective of a passive user. Initially, at block **542**, the credit preferences of the user are inputted and

distributed to the other users for effectuating the credit preference screening. At block **544**, the user sends an order to system **10** for distribution to the other users requesting a trade on a financial instrument. The user that placed the order must then wait for another trader to hit or lift the passive order, thereby executing the trade. Both parties to the trade will receive an execution notification which will allow one or both users to request an increase in quantity, as determined by block **548**. If this request is received from the party hitting or lifting the passive order, the first user accepts, denies, or amends the requested increase, as indicated by block **550**. If there is no request to increase a quantity, then it is determined at block **552** whether there is a request to negotiate terms of the financial instrument. This feature allows the users to change the default values for the non-commercial terms of the financial contract, as indicated by block **554**. Next, the first user will receive an acknowledgment of the execution of the trade with the second trader, as indicated by block **556**.

With reference to FIG. 27B, a flowchart **560** generally illustrates the steps of a trade from the perspective of the active user that lifted or hit the passive order. At block **562**, the second user receives an order from the first user requesting a trade on a financial instrument. The order is then checked for trade eligibility based upon the credit preferences of the first and second users, as indicated by block **564**. The order is coded with appropriate credit information based upon the credit check, as indicated by block **566**. The coded order is then presented to the second user based upon a preference or filter set by the second user to view orders of the present instrument, as indicated by block **568**. The second user then initiates a trade by lifting or hitting the order, as indicated by block **570**. In block **572**, it is determined if there is a request to increase quantity. If there is not a request to increase quantity, then the request is processed at block **574**. If there is not a request to increase the quantity, then it is determined at block **576** whether there is a request to negotiate terms of the financial instrument. This feature allows the users to change the default values for the non-commercial terms of the financial contract, as indicated by block **577**. Next, an acknowledgment is received by the first and second users indicating that the trade has been executed, as indicated by block **578**.

Another feature of the present invention is the position discovery as illustrated by a flowchart **580** of FIG. 28. At block **582**, risk position portfolios are received from the users of system **10**. At block **584**, relative position information is calculated for each user so that each user may be presented with possible trading combinations for their portfolios, and combinations of their portfolios against positions from the other users. The possible trading combinations are coded with credit preference information in accordance with the present invention. It is then determined at block **586** if a switch is requested. If a switch is not requested, then the process ends. However, if a switch is requested at block **586**, then a switch is executed at block **588**. The execution of the switch is performed in substantially the same manner as any other trade, as described above. Upon execution of the switch, the position information of each party to the switch is automatically updated to reflect the switch, as indicated by block **590**.

A blotter is provided to enable the user to keep track of all the orders he/she has inputted into the market. The blotter is preferably a screen whereby once it is activated, it displays all the outstanding orders a user has in the system. The blotter enables the user to monitor all his/her outstanding orders in many different instruments conveniently in one place. Preferably, there are two types of blotters. The first is the outstanding order blotter **320** which offers several functions to the user for managing his/her orders, such as the ability to change the price, or size of an order. This is accomplished through the use of dials on the windows which enable the user to quickly dial up or down the price without needing to cancel and then re-submit the order. This edit process shields the user from the complexity of order management regarding changed orders. This also prevents the user from accidentally having duplicate or no orders in the system **10**. The outstanding order blotter **320** also enables the user to quickly suspend (or refer) all of his/her active orders in the system **10**, and then re-input them one by one or delete them as necessary. Yet further, the outstanding order blotter enables the trader to cancel one or all of his orders. The second type of blotter is the historical order blotter **330**. From the historical order blotter, it is possible for the user to view all of his/her previously executed trades and the respective status, as well as those that have been canceled.

In order to address the needs of interest rate swap traders and portfolio managers, the system **10** may include a function known as the switch engine. The switch engine is

implemented by a switch interface **400** and enables the user to input an entire portfolio of interest rate reset risks into the system **10**, and then view out into the future for an unlimited time horizon on a daily basis. In a preferred embodiment, the user inputs the size (in millions) and the direction (receiving or paying) of the reset risks portfolio into the system **10** on a wide range of the most common interest indices (*i.e.*, 1 month US dollar libor, 3 month US dollar libor, 1 month DEM libor, *etc.*). The portfolio can be input either directly through the portfolio interface **380** (FIG. 21), or by uploading a file with the required information. Once the information has been input into the system **10**, the user is then asked to confirm the input. Once this information has been confirmed, the user then has the ability to anonymously look at his/her interest rate reset risk position relative to all other counterparties who have inputted such information to determine based upon credit preferences, which trades are available to him/her in the system **10** to off-set his/her interest rate reset risks. Once the user has located these trades, the user can then anonymously send a request-for-switch to the other counterparties in an attempt to initiate a trade.

The system **10** further provides the functionality to permit the trading of various financial instruments via an auction function, as generally illustrated in a flowchart **600** of FIG. 29. The system performs what is referred to herein as a two way Dutch auction with credit preferences. In this auction methodology, users submit orders into the auction giving both the price and the quantity at which they wish to trade, as indicated by block **602**. The auction process then begins by calculating the price at which the most volume is traded, as indicated by block **604**. This is called the auction-price. The auction-price is a fair price at which all transactions will be completed. In this calculation, the credit preferences of the various counterparties are not yet taken into account. At block **606**, the system matches up orders such that all credit preferences are taken into account such that the minimum number of tickets are generated. The better submitted prices have priority, and all orders at the auction-price are preferably filled in proportion to each other. In a preferred embodiment of the auction feature, the auction process could be conducted a few times a day in order to maximize liquidity. The system also offers the functionality to enable the user to trade forward rate agreement switches and other switch products in an auction environment similar to that described previously.

The system then automatically generates a confirmation for each transaction and sends it electronically via email, fax, or another means to the counterparties of each executed transaction, as indicated by block **608**. This unique confirmation process has been designed to use a standard and consistent format for all financial instruments.

At this point, a more detailed description of the operation and functionality of the auction mechanism **34** is provided. With reference to FIG. 30, the auction mechanism **34** initially receives an order list from those traders wishing to participate in an auction, as indicated by block **620**. The orders within the order list are separated into a BuyList and SellList, as indicated by block **622**. At block **624**, a price list is generated and sorted from highest price to lowest price. It is then determined at block **626** whether an auction will take place by determining if the price list is empty. If the price list is empty, then no auction takes place, as indicated by block **628**. If the price list is not empty, then the average auction price is calculated, as indicated by block **630**, and as described in greater detail with reference to FIG. 31. Next, the orders are matched such that the minimum number of tickets are generated, taking into account the credit preferences of all parties, as indicated by block **632**, and as described in greater detail with reference to FIGs. **32A** and **32B**. Once the orders have been matched, a settlement list is generated, representing the execution of transactions via the option, as indicated by block **634**.

With reference to FIG. 31, the average auction price is calculated. In particular, beginning at block **640**, the initial parameters are established, such as i=1, j=1, difference equal s1-b1, k=2, and N=size of price list. In addition, the total amount in the BuyList is B_i, and the total amount in the SellList is S_{N-i+1}. Next, it is determined at block **642** whether k=N+1. If so, then the average auction price is P_I. If it does not, then it is determined at block **644** whether difference is greater than 0. If it is, then parameter j is set to j=j+1, the parameter difference is set to difference = difference + B_J, and the parameter k is set to k=k+1, as indicated by block **646**. If not, then the parameter i is set to equal i=i+1, the parameter difference is set to difference=difference +S_I, the parameter k is set to k=k+1, as indicated by block **646.** The steps of block **642-648** are repeated until determination is made at block **642** that k=n+1.

With reference to FIG. 32, the step of matching orders in an auction is described in greater detail. In particular, items in the BuyList and SellList are eliminated according

to the average auction price, as indicated by block **650**. It is then determined at block **652** whether the size of BuyList is greater than zero and the size of SellList is greater than zero. If one or the other is not greater than zero, then the settlement list is generated, as indicated by block **654**. If both the BuyList and SellList are greater than zero, then the parameter Bsum is set to equal the total volume in BuyList and Ssum is set to equal the total volume in SellList, as indicated by block **656**. It is then determined at block **658** if Ssum is greater than the Bsum. If it is, then the parameter list1 is set to equal SellList and the parameter list2 is set to equal BuyList, as indicated by block **660**. Next, the order1 parameter is set to equal to the first order in list1 and order1 is removed from list1, as indicated by block **662**. The maximum/minimum and credit rules are then applied to search the BuyList for matching order2. A matching order2 is located and a trade is generated between order1 and order2, as indicated by block **666.** If at block **668** it is determined that Ssum is not greater than Bsum, then parameter list1 is set to equal BuyList and list2 is set to equal SellList, as indicated by block **668**. Next, order1 is set to equal the first order in list1 and order1 is removed from List1, as indicated by block **670**. Next, list2 is searched in order to find a match to order1 using the maximum-minimum rule and the credit preferences associated with the orders, as indicated by block **672** and described in greater detail with reference to FIG. 33. A trade is then generated between order1 and order2, as indicated by block **674.**

With reference to FIG. 33, the application of the maximum-minimum rule and credit rules satisfying an order are described in greater detail. Initially, it is noted that the parameter volume is equal to the volume of an order, and more particularly, of order1. At block **680**, it is initially determined whether the parameter volume equals 0 for order1. If it does not equal zero, then it is determined at block **682** whether list2 is empty. If list2 is not empty, then list2 is searched for the first matching order, as indicated by block **684.** Once a matching order is located, then the volume traded will equal to the minimum as defined by the credit preferences of either party, the volume of order1, or the volume of order2, as indicated by block **686**. It is then determined if the trade volume is 0, as indicated by block **688**. If the trade volume is 0, then the process begins again at block **680.** If the trade volume is not equal to 0, then a trade is generated and placed in the settlement list, as indicated by block **690**. In addition, at block **692**, order2 is removed

from list2. Next, the volume of order1 and order2 are updated by setting the respective volumes to the previous volumes minus the trade volume, as indicated by block **694.** It is then determined at block **696** if the volume of order2 is equal to zero. If it is not, then order2 is placed back in a temporary list and a credit of the parties placing order1 and order2 are updated, as indicated by block **698.** Once the volume of order1 is determined to be zero, then it is determined at block **702** whether the temporary list is empty. If it is not, then the temporary list is merged with the BuyList, as indicated by block **704**. Subsequently, the process ends.

The operation of the central processing center **12** is now generally described with reference to FIG. 34 which functionally depicts the group server mechanism **32**, the auction mechanism **34** and switch mechanism **35**, the market inventory module **38**, the execution module **40**, and the settlement module **42**. A legend **710** is provided to the denote the flow of the different orders, interactive and switch orders, auction orders, and switch auction orders, between the group server mechanism **32**, the auction mechanisms **34**, the market inventory module **38**, the execution module **40**, and the settlement module **42**. Beginning with the interactive/switch order generated by the user at one of the trader workstations **20**, the central processing center **12** initially receives the interactive/switch order **712** at the group server mechanism **32**. At the group server mechanism **32**, an order record is created, the credit preferences of the users are checked to assure the trade conforms to the current credit preferences of the users, and a transaction order is created. If the order is passive, then it flows through to the market inventory module **38** where is it distributed to the trader workstations **20** for viewing via respective market detail interfaces **302** of the users logged on the system **10**. If the order is active, then it flows through to the market inventory module **38** where order matching occurs if the order is a part of an auction, and pre-execution of the order also occurs. Pre-execution may include, for instance, a back-end credit check to ensure up to date credit preferences and to accommodate complex checks. Further, in a manner that is transparent to the users, the market inventory module **38** requires the trader workstations **20** of the respective users that are a party to the trade to respond with an acknowledgement to assure that there has been no loss of communication or that one of the users has not logged off. Upon receiving the acknowledgement, the market inventory module **38** executes the trade and

then publishes the updated volume and status to the users logged on to the system **10** for viewing via respective command center interface **130** of the users.

Next, the execution module **40** will, upon request of one of the users that were a party to the trade, enables the quantity of the trade to be increased via the will-do-more feature. This will typically be the case unless the full quantity of the instrument is transacted. Otherwise, the execution module will initiate the confirmation process which includes an opportunity for either of the users that were a party to the trade to enter into term negotiations.

The order the flows through to the settlement module **42** which initiates the settlement process. The settlement module allows for symbol explosion by the users to view the exact terms of the contract. Further, a settlement module calculates the commission based upon the order which ends the process, thereby noting the end of the order execution process.

In the case of an auction, an auction order **714** received by the auction mechanism **34**. The auction module **34** enables auction and switch auction functionality of the present invention. The auction module initially receives the auction orders **714** a from a plurality of users during a countdown to the actual auction time. Once the auction time has arrived and the auction orders have been submitted, the auction mechanism **34** performs the auction matching with credit preferences of the users taken into account. The auction matching performed by the auction mechanism **34** is in accordance with the present invention, that is, the auction is based on a fair price and executed for a maximum volume traded with a minimum number of tickets generated. From the auction mechanism **34**, once the counterparties have been matched the market inventory server essentially treats the resulting auction orders as though it would an interactive/switch order **712**. In particular, the market inventory module **38** perform order matching, pre-execution, acknowledgement, trade execution and volume/data publishing.

The auction order **712** is then delivered to the execution module **40**. At the execution module **40**, an auction order and a switch auction order are traded slightly different. For instance, an auction order may be increased in quantity by one of the users that is a party to the auction order via the will-do-more. On the other hand, switch auction orders do not make use of this feature, but will go directly to the confirmation

process. Further, where auction orders may also have their non-commercial terms negotiated using the term negotiation feature, switch auction orders will flow to the settlement module **42** directly after confirmation. Both auction orders and switch auction order are then received by the settlement module **42** which performs essentially the same operations to the auction order as it does to an interactive/switch order **712**. Specifically, the settlement order **42** provides similar explosion and commissioned calculations which complete the order process.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention set forth in the claims.

V. Reverse Auction According To One Embodiment of the Invention

For purposes of the following description, the eCFO™ system of the present invention is preferably implemented in conjunction with operable components and features of the Blackbird™ system which is described in detail above. The present invention may also be referred to herein interchangeably as the Blackbird reverse auction process. One objective of the present invention is to build an electronic infrastructure that maintains the Dealer-Client model while offering multiple access to dealers with all of the major advantages of electronic execution, all within one system. Another objective is to create value for requesters and posters by creating an efficient and cost reducing means to competitively trade OTC derivatives. It can also serve as a single dealer system if that is what is needed. CFO's and other users of the present invention (also referred to herein as eCFO™ system) will have the ability to simultaneously interact with one or more dealers with whom they have an existing credit and banking relationship. A qualified end-user may submit inquiries to one or many of these dealers and request pricing information or seek to enter into a transaction. Dealers are unencumbered by the system because end-users are prescreened based on their financial and credit worthiness, or credit preferences methodology, as discussed in detail previously herein. These two features have been well thought out and researched and are unlike anything available in the marketplace.

According to the present invention a qualified end-user (also referred to interchangeably herein as a requester, as the requester is seeking prices) may choose to remain anonymous or disclose their identity at anytime during the auction process. As a result, requesters will only be able to send requests to dealers with whom they have an existing banking relationship (*i.e.*, the only dealers that receive the request are those with whom the requester has granted sufficient credit for the proposed trade as determined by the Credit Preference Module) and price transparency is guaranteed by not having to reveal one's name while using the eCFO system. While the request is "in effect", responses come back from one or more dealers interested in a possible trade with the requester. If more than one response is returned, the requester evaluates the offers, chooses the best prices, and negotiates until both parties agree to a final price.

According to one aspect of the invention, the eCFO™ system can be implemented as an Internet portal site for CFO's, fund managers, and corporate treasury operations. It provides a location for third-party valuations, portfolio and risk management, and execution online with dealers of financial products. The client-to-dealer derivatives trading system gives clients affordable access to risk management tools, quotes from one or more derivatives dealers, and the ability to electronically enter into transactions.

The eCFO™ system is an alternative to a single dealer system allowing end-users with banking relationships with more than one financial institution to interact with them all through a single platform. Besides, allowing dealers to qualify end-users based on credit, the eCFO™ system allows for electronic negotiation and trading between end-users and one or more dealers directly and offers Straight-Through-Processing (STP) to seamlessly and accurately generate ticketing information. STP is the process by which trade details are electronically sent from the system's front end to the backoffice and risk management systems. This represents a huge improvement in the time it takes to enter into a transaction using traditional methods and the automatic processing eliminates errors caused by converting data from voice to electronic data storage.

By leveraging the Blackbird™ system, eCFO™ extends electronic execution capability and standard protocols to the Client-Dealer relationship. eCFO™ hosts each user's portfolio in a secure, private facility allowing users to subscribe to a number of value-added services (such as swaps processing, advanced risk management analysis, and

exotic trade pricing). This approach dramatically lowers the cost of doing business for both the end-user and provider of the product or service.

In summary, the eCFO™ system achieves these and other objectives by acting like a single dealer system, providing multi-dealer access while protecting existing dealer-client relationships, maintaining credit preferences and anonymity, utilizing common industry standard protocols, and creating backoffice efficiencies with Straight-Through-Processing (STP).

A client interested in entering into a derivatives transaction or accessing the system's risk management tools starts at the home page of the eCFO™ website and logs into the system via a login interface **750**, one embodiment of which is shown in FIG. 35. The login interface **750** requires the client to enter a username **752** and password **754**, which is verified by the system, granting them access to the system. Next, the system presents the client with a marketing screen (not illustrated) from which the client can tab to a variety of screens, in a similar method as discussed above with respect to FIG. 5. According to one aspect of the invention, the system allows the client to select a dealer selection interface **755**, illustrated in FIG. 36, which identifies only those dealers with whom the user presently has an existing relationship. Via the interface **755**, the user may select one dealer **760** or any with whom they have appropriate derivatives contract related documents in place and approved credit. The dealer may also identify an instrument **762** using the Symbology defined herein, as well as any messages relevant to the request for price.

In order for over-the-counter (OTC) derivatives trading to take place in an orderly and efficient fashion in an electronic environment, eCFO™ uses Blackbird™ Symbology™, as previously described in detail herein, which is a highly sophisticated naming convention that provides an easy-to-use reference for market participants transacting in complex financial instruments like derivatives. The Blackbird™ Symbology™ provides a method for transforming the verbose and time-consuming process of explaining the terms and conditions of highly complex OTC derivative products by systematically dividing the attributes, terms, and conditions of each derivative instrument into a four-part subject code, which enables the users to reference instruments using subject-based addressing. At any time users of the system can

"explode" the symbol to see the specifics of the transaction including start and end dates of the transaction, floating rate options, accrual basis, and so forth.

The symbol captures the commercial terms of a derivatives transaction, that is, the parameters affecting its valuation. In order to offer the maximum flexibility and allow for the execution of more complex spread and curve trades, the system offers the Term Negotiations™ feature. Although defaults are provided, this feature enables traders to have the flexibility to negotiate the noncommercial terms to a transaction themselves. This would include parameters such as the number of bonds to be exchanged, and the legal format of the agreement to be used.

With most trading scenarios, each party receives or sells an instrument of relative value in the transaction (i.e., security for cash). Neither party has any further obligation. In a derivatives transaction, no exchange of principal actually occurs and both counterparties may end up with multi-year financial commitments to one another once a trade is executed. As a result, it is very important to understand the other party's financial well being in advance of any trade. The eCFO™ system allows dealers to manage their credit preferences of clients by using Blackbird's Credit Preferences technology to filter incoming quote requests. Because of the potential credit exposure/risk resulting from the transaction, the better the credit quality the better the price. An element of pricing considers the credit quality of the counterparty. So, it may not be advantageous for a counterparty to reveal their identity especially if they are sensitive to price. For example, if prices are coming in from more than one end-user, a dealer may choose to deal with an end-user possessing the most favorable credit rating even if other clients have sufficient credit. For this reason, eCFO™ also allows all counterparties to remain anonymous unless they chose to reveal themselves.

eCFO™ features a unique reverse auction process that considers dealers credit preferences and allows all parties to remain anonymous while using the system. If an end-user wants to inquire about a particular instrument, the end-user initiate a "Request For Price" (RFP) and send it to one or more dealers based on the end-user's particular needs. Thus, even if there is not a market in a desired instrument, an end-user may create a market for the instrument by initiating the reverse auction by send out a Request-For-Price, or RFP, to selected parties (as fitted by the Credit Preference Module) able to post

prices or make markets for a particular instrument. This function enables the requester to send a message requesting a price in the desired instrument to all other users in the system who are interested in that instrument. As part of this process, the sender of the message may post either a bid or an offer in the desired instrument to start the market or just solicit interest and ask for pricing.

The RFP is filtered by the eCFO™ system using Blackbird's Credit Preferences and proper credit is validated by the system. According to one aspect of the invention, if the RFP is approved by the system to be sent to all selected dealers, a message is displayed showing the end-user's name unless they chose to remain anonymous, the direction (i.e. market, bid or ask) of the instrument, notional amount, and time allowed to dealers for a response before the RFP expires. According to one aspect of the invention, a popup dialog box **770** illustrated in FIG. 39 will pop up to all RFP recipients that have credit to the requester affording them an opportunity to indicate whether or not they have any interest in the selected instrument

If credit is an issue, a notice is sent to the appropriate dealers notifying them that a client sent an inquiry but the message was withheld by the system because proper credit has not been established. The dealer is then asked by the system to accept the denial or update the credit preferences within a reasonable timeframe. This may occur via a popup dialog box **780**, which allows a dealer to approve credit for a end-user regarding a particular transaction. If 'approve' **782** is selected, the end-user will be allowed to participate in the reverse auction process. If 'no interest' **784** is selected, the dialog box disappears and the RFP process ends for the particular recipient. Additionally, according to one aspect of the present invention, if the dealer fails to respond within that timeframe, the request is terminated. The requestor is also notified of the lack of sufficient credit to enter into a trade with the one or more dealers in question. Various financial instruments have different credit qualities so it is possible that a dealer will accept an end-user's credit for one instrument and not another.

If a client's credit is validated, then an RFP message is sent to the appropriate dealers via a request for price interface **790**, as shown in FIG. 39. The interface **790** includes the specified instrument **792**, the bid **795** and ask **796** quantity, and the end-user's credit rating **794**, as described in great detail above. The interface may also

include price levels, and information about the quantity, or notational amount, of the proposed trade, the bid or ask price, and the time before the RFP expires. As shown in FIG. 39, the name of the end-user defaults to "Anonymous" **793** unless the end-user chooses to reveal their identity. A dealer can then elect to respond to the RFP by submitting a change to the bid or ask side of the trade, canceling the trade, or doing nothing and letting the RFP expire. Additionally, it should be appreciated that the client may receive responses from one or more dealers.

FIG. 41 illustrates price acknowledgement interface **805** presented to an end-user after a counteroffer is presented to the end-user from a dealer. If the client decides to execute at a price or negotiate, a message is sent back to the dealer or dealers. This may continue until both the client and the dealer may continue negotiating until they arrive at an agreement on price. Otherwise, the end-user can cancel the transaction. Therefore, the reverse auction process allows the client to select the best price or choose to negotiate with one or more dealers at the click of a button without the difficulties of traditional voice-based systems.

Agreeing to the terms of the transaction is easy to do because the eCFO™ system takes advantage of Blackbird™ Symbology™ naming conventions, which allow for the seemingly endless array of possible parameters to be displayed in an easy-to-understand format. A client upon receiving a message from the dealer may choose to hit, lift, or cancel the RFP. However, if the dealer and the client decide on the terms of the trade and come to an agreement on the price, the aggressor may initiate a Will-Do-More (WDM) screen letting the other party know they are willing to trade a larger notional amount that is currently stated in the system. After which, Blackbird's Term Negotiations screen is displayed, allowing the client and/or the dealer to edit the non-price sensitive elements of the transaction.

FIG. 40 shows an illustrative request for price market interface through which a dealer can respond to and manage RFPs received from end-users. More specifically, FIG. 40 shows the information for a USD 5 year swap spread including bid and ask prices. The dealer uses the staging area **802** on the right hand side to change the bid or ask side of the trade, cancel the trade, or do nothing and let the RFP expire. If the end-user has requested a "market", the dealer can make prices on either the bid and the ask

side, or both. If a request is bid only, then only the bid side is enabled. If a request from the end-user is ask only, then only the ask side is enabled. All prices posted by the dealer will be displayed in relative position to their own prices and others. If a quantity is not disclosed, the dealer can specify a quantity of any size. However, if the end-user has selected a specific quantity, the dealer cannot show more than the size shown and can only execute up to that amount.

The end-user RFP requester will then get a response for the instrument from the posting dealer and will be given a chance to respond using the price acknowledgement interface illustrated in FIG. 42. In the "Outgoing RFP" column, all instruments where the poster has entered prices are displayed. In the "Best Bid" and "Best Ask" columns, requester and poster bid and ask prices are displayed. The trading area on the right side of the window can be used to hit or lift the order in quantities up to or less than the amount posted. Only one action is allowed per RFP. Requester can select a limit price and quantity.

Once a trade has been executed, a "Will-Do-More" (WDM) window pops up (not illustrated) that asks the requester to update the notional is he would like to trade more than the amount originally posted at that particular price. After the trade has been completed, the results of the auction will be sent to all RFP posters in that particular instrument that listed prices at or near the levels traded. The criteria for inclusion of the results can be adjusted, but a range may be set near the executed price or spread level.

FIG. 43 illustrates a flow chart representing a reverse auction transaction between at least one end-user and at least one dealer, according to one embodiment of the present invention. As illustrated at step **809**, the end-user initially determines whether the end-user's name will be revealed, and indicates a request for price, a notational amount, and the time allowed before the RFP expires. After the RFP is transmitted **810** via network communications to one or a plurality of dealers, the end-user's credit is examined by the credit preference module **811**, **812** to determine whether the end-user is authorized to enter into the proposed trade with any of the dealers to whom the RFP was transmitted. If the end-user's credit is approved, the RFP is displayed to the approved dealers **814**, which may respond to the RFP **816**. Otherwise, the customer and dealers are notified of the credit issue **813**, and credit may be negotiated **815** on a dealer-by-dealer basis, as

explained in detail above. If the end-user does not agree with a dealer response to the RFP **816**, the price and terms of the RFP may be negotiated **817**, or the transaction may be cancelled. If negotiations continue, the process begins again at block **809**. On the other hand, where an end-user agrees with an RFP, the end user and dealer may enter into 'will-do-more' **818** and term **820** negotiations. Finally, details of the trade may be displayed to the end-user and dealer **822**, and trade details may be sent to both parties.

Using the system of the present invention the client or the dealer may also initiate the generation of trade tickets. Both parties of the transaction are presented with a settlement statement. eCFO™ utilizes Blackbird™ 's Settlement Server to send trade tickets electronically (e.g., XML) or by fax. After the transaction is completed, both parties may view the price and terms the transaction, at any time, including start and end dates, floating rate options, accrual basis, and so on. This allows both counterparties to ensure that the trade details reflect what was agreed upon.

The present invention may also include other features offered by way of user interfaces and tools. According to one aspect of the present invention, these interfaces and tools are in communication via a WAN, LAN, Internet, or the like, with data providers such that a client can obtain a wealth of financial and/or market information. For instance, through a portfolio tab or link accessible by the end-user from the marketing screen, a data interface screen, or the like, the end-user may access their portfolio of existing derivatives transactions listing details such as dealer name (legal entity and/or business unit name), type of derivative/financial instrument, currency, start and end dates, and rate. Additionally, through a model and price tab or link an end-user may electronically notify one or more dealers they have a relationship with and request a quote on a particular structure. Therefore, the eCFO™ system of the present invention allows the user to select the type of financial instrument being traded, using Blackbird™ Symbology™, and the appropriate terms of the transaction (i.e. symbol, parameters, trade date, currency, accrual basis, etc.). A "request for a quote" message can then be sent to one or more dealers asking them to respond based on the parameters selected. Furthermore, via one or more tabs or links end-users can access market information, establish alert parameters that, when reached, tells eCFO™ to automatically send a

message to the client about the event or situation, and/or speak with client service client service representatives of the system.

Transacting (Client to Dealer)

A client may initiate a transaction in an instrument by requesting a quote from one or more dealers with whom they have an existing relationship. Dealers may also initiate the contact. As part of this process, the sender of the message is required to provide a few details about the desired instrument. Clients or dealers receiving the message who are interested can respond immediately with a quote or request additional information.

Once the client and the dealer have agreed to the terms of the trade, the client can execute the order to enter into the transaction. From within eCFO™, the Blackbird system will be used to select the appropriate terms using Blackbird™ Symbology™ (symbols, parameters, trade dates, currencies, etc.). According to one aspect of the invention, the confirmation process will be automatic and will initially follow current practices in the OTC derivatives market. All faxes will be sent immediately after a transaction is completed. Additionally, all confirmations will follow a standard convention and allow for the automatic transfer of these confirmations electronically. All records can be recalled at a later time.

Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation